NASA/TM-2016-219355

A Bibliography of Transonic Dynamics Tunnel (TDT) Publications

Robert V. Doggett, Jr.
Distinguished Research Associate
NASA Langley Research Center
Hampton, Virginia

December 2016

NASA STI Program . . . in Profile

Since its founding, NASA has been dedicated to the advancement of aeronautics and space science. The NASA scientific and technical information (STI) program plays a key part in helping NASA maintain this important role.

The NASA STI program operates under the auspices of the Agency Chief Information Officer. It collects, organizes, provides for archiving, and disseminates NASA's STI. The NASA STI program provides access to the NTRS Registered and its public interface, the NASA Technical Reports Server, thus providing one of the largest collections of aeronautical and space science STI in the world. Results are published in both non-NASA channels and by NASA in the NASA STI Report Series, which includes the following report types:

- TECHNICAL PUBLICATION. Reports of completed research or a major significant phase of research that present the results of NASA Programs and include extensive data or theoretical analysis. Includes compilations of significant scientific and technical data and information deemed to be of continuing reference value. NASA counter-part of peer-reviewed formal professional papers but has less stringent limitations on manuscript length and extent of graphic presentations.
- TECHNICAL MEMORANDUM. Scientific and technical findings that are preliminary or of specialized interest, e.g., quick release reports, working papers, and bibliographies that contain minimal annotation. Does not contain extensive analysis.
- CONTRACTOR REPORT. Scientific and technical findings by NASA-sponsored contractors and grantees.
- CONFERENCE PUBLICATION. Collected papers from scientific and technical conferences, symposia, seminars, or other meetings sponsored or co-sponsored by NASA.
- SPECIAL PUBLICATION. Scientific, technical, or historical information from NASA programs, projects, and missions, often concerned with subjects having substantial public interest.
- TECHNICAL TRANSLATION. English-language translations of foreign scientific and technical material pertinent to NASA's mission.

Specialized services also include organizing and publishing research results, distributing specialized research announcements and feeds, providing information desk and personal search support, and enabling data exchange services.

For more information about the NASA STI program, see the following:

- Access the NASA STI program home page at *http://www.sti.nasa.gov* E-mail your question to help@sti.nasa.gov
- Phone the NASA STI Information Desk at 757-864-9658
- Write to:

  NASA STI Information Desk
  Mail Stop 148
  NASA Langley Research Center
  Hampton, VA 23681-2199

NASA/TM-2016- 219355

A Bibliography of Transonic Dynamics Tunnel (TDT) Publications

Robert V. Doggett, Jr.
Distinguished Research Associate
NASA Langley Research Center
Hampton, Virginia

December 2016

ACKNOWLEDGMENTS

Through the efforts of Stanley R. Cole, who is the Head of the Aeroelasticity Branch at the NASA Langley Research Center, every current member of this branch, a number of former members, and other persons who have tested in the Transonic Dynamics Tunnel (TDT) were provided a draft of this monograph with a request that they check to see if any of their publications were overlooked. The author thanks those who took the time to conduct the requested review. In particular, he sends a special thank you to those who found some omissions or other errors, and passed that information on to him. These individuals are: Vanessa V. Aubuchon, Stanley R. Cole, Juan R. Cruz, Wayne R. Mantay, Steven J. Massey, Vivek Mukhopadhyay, Jeremy T. Pinier, Wilmer H. Reed, III, and William T. Yeager, Jr.

Despite the fine efforts of these reviewers, any remaining omissions or errors are the sole responsibility of the author.

The art work on the cover is adapted from an original graphic prepared by G. Lee Pollard, an accomplished artist, in commemoration of the 50th anniversary of the TDT.

Available from:

NASA STI Program
Mail Stop 148
NASA Langley Research Center
Hampton, VA 23681-2199

National Technical Information Service
5285 Port Royal Road,
Springfield, VA 22161

This report is also available in electronic form at: http://www.sti.nasa.gov/ and http.//ntrs.nasa.gov/.

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

TABLE OF CONTENTS (CONCLUDED)

ABSTRACT

The Transonic Dynamics Tunnel (TDT) at the National Aeronautics and Space Administration's (NASA) Langley Research Center began research operations in early 1960. Since that time, over 600 tests have been conducted, primarily in the discipline of aeroelasticity. This paper presents a bibliography of the publications that contain data from these tests along with other reports that describe the facility, its capabilities, testing techniques, and associated research equipment. The bibliography is divided by subject matter into a number of categories. An index by author's last name is provided.

ACRONYMS

A number of acronyms are used in the citations included in the bibliographic listing. Some are defined below. Others are defined as they occur in the listing.

AAW	Active Aeroelastic Wing
ACROBAT	Actively Controlled Response of Buffet-Affected Tails
AEI	Aerodynamic Efficiency Improvement
AFW	Active Flexible Wing
ANCAR	Adaptive Neural Control of Aeroelastic Response
ARES	Aeroelastic Rotor Experimental System (not to be confused with the Ares launch vehicle)
Ares	Launch vehicle (Constellation Program)
ARW-1	First research wing in the DAST program
ARW-2	Second research wing in the DAST program
ATTACH	Airfoil THUNDER Testing to Ascertain Characteristics
BACT	Benchmark Active Control Technology
BERP	British Experimental Rotor Program
BVI	Blade Vortex Interaction
CCV	Control Configured Vehicle
DAST	Drones for Aerodynamic and Structural Testing
HHC	Higher Harmonic Control
HILDA	High Lift Over Drag Active Wing
HSCT	High Speed Civil Transport
HSR	High Speed Research
MAVRIC	Models for Aeroelastic Validation Research Involving Computations
NASP	National Aerospace Plane Program

PAPA	Pitch and Plunge Apparatus
PARTI	Piezoelectric Aeroelastic Tailoring Investigations
SIO	Shock Induced Oscillation
SPIE	The International Society for Optical Engineering
SST	Supersonic Transport
THUNDER	Thin-Layer Composite-Unimorph Piezoelectric Driver and Sensor
WRATS	Wing and Rotor Aeroelastic Test System

INTRODUCTION

The Transonic Dynamics Tunnel (TDT) at the National Aeronautics and Space Administration's (NASA) Langley Research Center has been devoted primarily to investigations of aeroelastic phenomena since the first research test began in early 1960. However, as the NASA has closed many other wind tunnels in recent years, a significant portion of the TDT testing is now outside the area of aeroelasticity.

The TDT is a conversion of the almost circular test section, low-speed 19-Foot Pressure Tunnel that became operational in June 1939 into a transonic tunnel with a 16-foot-square test section with cropped corners. This conversion cost slightly more than $9,500,000. The TDT operates from near vacuum to atmospheric pressure using either air or the refrigerant gas R134a as the test medium. The maximum Mach number is about 1.2 in each gas. The original tunnel utilized either air or Freon 12[1] as the test media, with Freon being the primary gas used. The tunnel was converted from Freon capability to R134a operations in 1997 because of environmental considerations. The gas R134a is more environmentally friendly than is Freon, but the characteristics important to wind-tunnel testing for aeroelastic phenomena are virtually the same for the two gases. The higher density of R134a as compared to air—about four time larger—is advantageous for aeroelastic studies because models can be made heavier thus making it easier to fabricate scaled models of full-scale designs with the fidelity needed for aeroelastic testing. The lower speed of sound as compared to air—about one half—affects the time scale so model vibration natural frequencies (or helicopter blade rotational speeds) are lower for a model scaled for testing in R134a as compared to one designed for testing in air. Furthermore, it requires less electrical power to operate in the heavier gas than it does in air to obtain the same Mach number and dynamic pressure. Moreover, the Reynolds number in R134a is more than twice its value in air at the same Mach number and dynamic pressure. It is desirable to have the Reynolds number as large as possible.

In addition to its heavy gas capability, the TDT is equipped with a number of features that facilitate conducting aeroelastic tests safely. The facility has a flow short circuiting device that can be used to rapidly reduce the flow velocity in the test section when an aeroelastic instability is encountered. If allowed to go unchecked, aeroelastic instabilities, such as flutter vibrations, will often severely damage the model. Extensive screening is provided to protect the fans blades from debris from a damaged model, which is not rare even with the flow slowdown capability. Because the tunnel control room is located within the plenum chamber, test engineers have a considerably better view of the models than do test personnel in most other wind tunnels. In aeroelastic testing is it very important that test personnel have a clear view of the models. A high-intensity lighting system provides illumination for all types of high-speed photographic coverage. A means to sinusoidally oscillate the test section flow is available for gust response studies. A number of different model mounting systems are provided. These include the traditional sting and sidewall capabilities found in most wind tunnels plus additional features such as

[1] "Freon" is a registered trademark of DuPont.

an oscillating turntable in the tunnel sidewall for pitching wing models for studies of unsteady aerodynamic pressures and loads, and a remotely controlled turntable on the tunnel floor for use in determining the loads and responses of launch vehicle models to simulated ground winds. Ground winds approaching from different azimuth angles are replicated by rotating the turntable. Moreover, there is a two-cable suspension system that provides a means for "flying" full-span, dynamically scaled aeroelastic models of full-scale airplanes, thus providing for the simulation of rigid body motions along with elastic structural deformations.

During its fifty-five years of operation there have been more than 600 tests conducted in the TDT. Airplane tests ranged from simple, inexpensive wing models cut from aluminum sheet to very expensive, full-span, dynamically scaled aeroelastic models of actual full scale configurations. Launch vehicle investigations included buffeting loads and response tests as well as ground wind loads studies. There have been a variety of rotary wing investigations. Some of these employed models of conventional helicopter configurations whereas others focused on tiltrotor designs. A number of studies measured unsteady pressures for use in calibrating and validating unsteady aerodynamic theories. There have been a number of tests in other dynamics areas such as determining parachute deployment characteristics and performance. Until recently, the facility was only utilized for non-aeroelastic tests when one or more of its unique characteristics were needed to provide the needed simulation. For example, the tunnel was chosen for use in a number of tests supporting the Viking Mars mission project because of its large size, and its capability to independently vary speed and pressure over a broad range of parameters. Additionally, the turntable that was developed for use in ground wind loads studies of launch vehicles facilitated testing some Viking models. In recent years the tunnel is finding more non-aeroelastic uses at Langley as more and more wind tunnels are decommissioned.

Although the results of every test have not been documented in a publication, many have been. Furthermore, there have been a number of papers published that describe tunnel characteristics and capabilities, as well as its associated research equipment.

The purpose of this monograph is to present a bibliography of the reports "directly associated" with the TDT. Directly associated means that the report contains information that either describes some characteristics of the facility, discusses model(s) used therein, explains testing techniques, or provides data obtained during TDT tests. Some papers that are primarily of a theoretical nature are listed when results from the analytical methods, often new or unique procedures, are evaluated by comparisons with experimental data from TDT tests even though the basic experimental data may be available elsewhere. An earnest attempt has been made to find everything that meets the aforementioned criteria as of December 31, 2015.

An index by author's last name is provided at the end of this document. The index includes the names of all authors, not just those of primary authors.

Characteristics of the Bibliography

The bibliography presented in the next section is a comprehensive listing of published documents that contain descriptions of various aspects of the Langley Transonic Dynamic Tunnel

(TDT) and/or present experimental results from tests conducted therein from the time the first research test began in February 1960 through December 2015. Many documents are devoted more or less exclusively to a particular TDT test, whereas others contain information from a number of tests, or just touch on the facility in a tangential way. A conscious attempt has been made to make the listing inclusive as opposed to being exclusive.

As mentioned previously some of the entries in the bibliography include data from several investigations. On the other hand, there may be several papers resulting from a single study. All the entries that contain data from multiple investigations are annotated briefly at the end of the citation to indicate what studies are included. Some others are annotated as well, generally those where the thrust and general content of the paper is not evident from the title.

When essentially the same paper was published in more than one format, such as a conference presentation that was later converted to a journal article, it is generally combined into a single entry. The latest version is the primary listing with the other version or versions indicated parenthetically. The same applies to papers that are published simultaneously in two forms, such as a conference paper and the exact same paper issued simultaneously as a NASA technical memorandum. If the title of the secondary reference is the same as the primary one, then the title is usually not repeated. Papers that are very similar, but not literal duplicates, are listed as multiple entries.

The bibliographic listing is subdivided by subject matter into several categories as indicated in the Table of Contents. The papers are listed alphabetically by principle author's last name in each category. It is not always clear, however, into which category a particular paper belongs. Readers should take that into account when trying to locate papers on a particular subject. For example, papers describing measurements of randomly varying unsteady aerodynamic pressures could have been indexed under Category 3.7.2 Unsteady Pressure and Force Measurements or Category 3.6 Flutter/Divergence/Buffeting/Gust Studies. In this situation, the author chose Category 3.6 because he thought the papers bore a stronger relationship to buffeting than to conventional unsteady pressure measurements. Many papers include both experimental and analytical results. In situations where the main thrust of the paper was on the theoretical side, the paper is included in section 6.0 Comparisons of Theory with Experiment. When the main thrust is on the experiment, the paper is listed in a specific technical category, such as Section 3.6 Flutter/Divergence/Buffeting/Gust Studies. Once again, the reader is cautioned that the choice was not always obvious.

BIBLIOGRAPHIC LISTING

1.0 SUMMARIES (highlight results from more than one test)

1.1 Surveys/Overviews

1. Abel, Irving: *Research and Applications in Structures at the NASA Langley Research Center*. NASA TM-110311, Jan. 1997. [F-18E/F flutter clearance, PARTI, BACT model, ACROBAT, WRATS]
2. Abel, Irving: *Research and Applications of Aeroelasticity and Structural Dynamics at the NASA Langley Research Center*. NASA TM-1112852, May 1997. [PARTI, BACT model, HSR rigid semi-span model]
3. Bartels, Robert; Chwalowski, Pawel; Funk, Christie; Heeg, Jennifer; Hur, Jiyoung; Sanetrik, Mark; Scott, Robert; Silva, Walter A.; Stanford, Bret; and Wieseman, Carol: *Ongoing Fixed Wing Research within the NASA Langley Aeroelasticity Branch.* AIAA Paper 2015-2719, 33rd AIAA Applied Aerodynamics Conference, Dallas, TX, June 22-26, 2015. [overview of contemporary research, a combination of wind-tunnel tests and analytical studies]
4. Cole, Stanley R., editor: *Technical Activities of the Configuration Aeroelasticity Branch.* NASA TM-104146, Oct. 1991. [overview of research program including; a general description TDT and its capabilities; highlight results from a number of airplane tests including flutter characteristics of a supersonic transport arrow wing, effects of spoilers on wing flutter, effects of planform curvature on wing flutter, effects of changes in tip geometry on wing flutter, and the Benchmark Models Program; information on a number of helicopter studies such as rotorcraft vibration reduction, and the use of extension twist coupling in composite rotor blades as well as a description of ARES]
5. Doggett, Robert V., Jr.; and Cazier, F. W., Jr.: *Aircraft Aeroelasticity and Structural Dynamics Research at the NASA Langley Research Center—Some Illustrative Results*. Sixteenth Congress of the International Council of the Aeronautical Sciences (ICAS), Jerusalem, Israel, Aug. 28-Sep. 2, 1988. (Also available as NASA TM-100627, May 1988.). [speed brake effects on flutter, arrow wing flutter, unusual instability boundary for transport wing, A-6 flutter clearance, twin vertical tail buffeting, advanced rotor blades]
6. Garrick, I. E.; and Reed, Wilmer H., III: *Historical Development of Aircraft Flutter*. Journal of Aircraft, Vol. 18, No. 11, Nov. 1981, pp. 897-912. (Originally AIAA Paper 1981-0491, 41st AIAA/ASME/ASCE/AHS Structures, Structural Dynamics, and Materials Conference, Atlanta, GA, Apr. 6-8, 1981.) [briefly describes the TDT's role in the history of flutter research and development]
7. Hanson, Perry W.: *Aeroelasticity at the NASA Langley Research Center–Recent Progress, New Challenges*. NASA TM-87660, Dec. 1985. [unsteady pressures on clipped delta-wing, high-aspect-ratio wing with control surfaces, and rectangular supercritical wing models, and on ARW-2 wing; supercritical airfoil shape effects on flutter; unusual instability for ARW-2 wing; flutter of two-engine transport wing with winglet; F-16 flutter clearance; YF-17 active flutter suppression]
8. Perry, Boyd, III; and Noll, Thomas E.: *Activities in Aeroelasticity at NASA Langley Research Center.* Fourth International Symposium on Fluid-Structure Interactions, Aeroelasticity, and Flow-Induced Vibrations and Noise, Dallas, TX, Oct. 16-21, 1997.

[PARTI, benchmark active controls, ACROBAT, HSR, WRATS, low vibration rotor blades]

9. Reed, Wilmer H., III: *Aeroelasticity Matters: Some Reflections on Two Decades of Testing in the NASA Langley Transonic Dynamics Tunnel*. Collected Papers of International Symposium on Aeroelasticity, DGLR-Bericht 82-01, Oct. 5-7, 1981, pp. 105-120. (Also available as NASA TM-83210, Sep. 1981. A 16-mm movie (also available in DVD format) entitled *Aeroelasticity Matters* compliments this paper. Same paper was presented at the International Workshop on Wind Tunnel Modeling, National Bureau of Standards, Gaithersburg, MD, Apr. 14-16, 1982.) [experimental techniques for airplane and launch vehicle model testing; C-141, F-14, and F-16 flutter clearance studies; effect of deflected elevator on T-tail flutter (C-141); Saturn V-Apollo, Space Shuttle, and Titan III ground-wind loads models; Lockheed Electra propeller whirl flutter; B-52 CCV model gust response; decoupler pylon; F-16 active flutter suppression; subcritical divergence prediction techniques; divergence of series of forward-swept wing models; unsteady pressures on high-aspect-ratio wing with oscillating control surfaces; helicopter HHC]
10. Ricketts, R. H.: *Selected Topics in Experimental Aeroelasticity at the NASA Langley Research Center*. Paper No. 85-70, Second DGLR/DFVLR International Symposium on Aeroelasticity and Structural Dynamics, Aachen, Germany, Apr. 1-3, 1985. (Also available as NASA TM-86436, Apr. 1985.) [subcritical response methods for flutter onset prediction; description of PAPA; body freedom flutter (X-29A); JVX (V-22) tiltrotor; Gulfstream III, two-engine transport, and four-engine transport with winglet flutter; airfoil shape effects on flutter; flutter of curved (wrap around) wings; ARW-2 wing instability; decoupler pylon].

1.2 Annual Reports of the Loads and Aeroelasticity Division

1. Gardner, James E.: *Loads and Aeroelasticity Division Research and Technology Accomplishments for FY 1982 and Plans for FY 1983*. NASA TM-84594, Jan. 1983. [F-16E vertical tail and wing flutter clearance, F-16 and YF-17 active flutter suppression, flutter of aeroelastically tailored wing, flutter of four-engine transport model with winglet, evaluation of subcritical response methods for flutter onset prediction, helicopter blade parametric tip study]
2. Gardner, James E.; and Dixon, S. C.: *Loads and Aeroelasticity Division Research and Technology Accomplishments for FY 1983 and Plans for FY 1984*. NASA TM-85740, Jan. 1984. [unusual instability for DAST ARW-2 wing, F-16 flutter clearance, flutter of two-engine transport with winglet, Galileo decelerator, F-16 decoupler flight test configuration, body freedom of forward-swept wing (X-29A), development of flutter models for testing at high Reynolds number in cryogenic wind tunnel]
3. Gardner, James E.; and Dixon, S. C.: *Loads and Aeroelasticity Division Research and Technology Accomplishments for FY 1984 and Plans for FY 1985*. NASA TM-86356, Jan. 1985. [spanwise curvature effects on wing flutter, X-wing divergence, flutter of four-engine transport with winglet, F-16 flutter clearance, JVX (V-22) tiltrotor test and analysis]
4. Gardner, James E.; and Dixon, S. C.: *Loads and Aeroelasticity Division Research and Technology Accomplishments for FY 1985 and Plans for FY 1986*. NASA TM-87676, Jan. 1986. [propfan testbed flutter clearance, JVX (V-22) tiltrotor, tunnel density increase (re-powering motor)]

5. Gardner, James E.; and Dixon, S. C.: *Loads and Aeroelasticity Division Research and Technology Accomplishments for FY 1986 and Plans for FY 1987*. NASA TM-89084, Jan. 1987. [A-6 flutter clearance, unusual instability for DAST ARW-2, F-16 adaptive active flutter suppression, initial AFW test, tests of growth UH-60 Blackhawk rotor blades]
6. Gardner, James E.; and Dixon, S. C.: *Loads and Aeroelasticity Division Research and Technology Accomplishments for FY 1987 and Plans for FY 1988*. NASA TM-100534, Jan. 1988. [study of improved F-16 adaptive flutter suppression system, speed brake effects on wing flutter, twin vertical tail buffeting, AFW test]
7. Gardner, James E.: *Structural Dynamics Division Research and Technology Accomplishments for FY 1988 and Plans for FY 1989*. NASA TM-101543, Jan. 1989. [span reduction effect on arrow wing flutter, flutter of generic arrow wing SST, F-16 flutter clearance, tip shape effects on wing flutter, 72^{o}-sweep delta wing flutter, 2nd A-6 flutter clearance test, MILSTAR radome response, spoiler effects on wing flutter, ATLAS II buffeting, description of PAPA, supercritical airfoil on PAPA, laser light sheet flow visualization system, oscillating flow field measurements for rotor blade applications, rotor blade tracking, advance design rotor blades]

1.3 Annual Reports of the Structural Dynamics Division

1. Smith, Jacqueline G.; and Gardner, James E.: *Structural Dynamics Division Research and Technology Accomplishments for FY 1989 and Plans for FY 1990*. NACA TM-101683, Jan. 1990. [planform curvature effects on wing flutter, flutter and divergence of all-moveable delta wing, aileron-buzz of generic NASP model, AFW open- and closed-loop flutter characteristics, flutter of joined-wing high-altitude vehicle, tip shape effects on wing flutter, Atlas II ground wind loads, rotorcraft vibration reduction by using non-structural mass, rotor-blade higher-harmonic-pitch control for reducing BVI noise]
2. Wynne, Eleanor C.: *Structural Dynamics Division Research and Technology Accomplishments for F.Y. 1990 and Plans for F.Y. 1991*. NASA TM-102770, Jan. 1991. [aileron buzz of generic NASP model, A-12 flutter clearance, trailrotor flutter, first benchmark models test, helicopter rotor blade nodalization, parametric hingeless rotor, heavy gas reclamation system modifications, data acquisition system improvements]
3. Wynne, Eleanor C.: *Structural Dynamics Division Research and Technology Accomplishments for F.Y. 1991 and Plans for F.Y. 1992*. NASA TM-104188, Jan. 1992. [modifications to heavy gas reclamation system, data acquisition system improvements, AFW multi-function active control, NACA 0012 benchmark model tests, ARES improvements, rotor blade optimization validation tests]
4. Wynne, Eleanor C.: *Structural Dynamics Division Research and Technology Accomplishments for F.Y. 1992 and Plans for F.Y. 1993*. NASA TM-107713 Jan. 1993. [B777 flutter clearance test, benchmark model unsteady pressure measurements, flutter of HSCT wing, BERP rotor blades, slotted airfoil rotor blades, modifications of heavy gas reclamation system, data acquisition system improvements]
5. Wynne, Eleanor C.: *Structural Dynamics Division Research and Technology Accomplishments for F.Y. 1993 and Plans for F.Y. 1994*. NASA TM-109034, Jan. 1994. [B767 flutter and buffet, Gulfstream V flutter clearance, aeroelastic study of generic NASP full-span configuration, advanced rotor blades (baseline and growth UH-60 Blackhawk blades, BERP blades)]

1.4 Annual Reports of the Langley Research Center

1. Anonymous: *Langley Research Center Annual Report on Research and Technology Accomplishments 1978.* Nov. 1, 1978. [Space Shuttle flutter, buffet, and ground wind loads; rotorcraft vibration]
2. Anonymous: *Research and Technology: 1980 Annual Report of the Langley Research Center*. NASA TM-81910, Nov. 1980. [divergence of forward swept wings]
3. Anonymous: *Research and Technology: 1981 Annual Report of the Langley Research Center*. NASA TM-83221, Nov. 1981. [control surface unsteady aerodynamics, helicopter vibration reduction (HHC)]
4. Anonymous: *Research and Technology: 1982 Annual Report of the Langley Research Center*. NASA TM-84570, Nov. 1982. [two-degree-of-freedom flutter mount system (PAPA), angle-of-attack effects on transonic flutter, F-16 active flutter suppression]
5. Anonymous: *Research and Technology: 1983 Annual Report of the Langley Research Center*. NASA TM-85702, Nov. 1983. [pressure distribution on oscillating rectangular supercritical wing, correlation of hingeless rotor analysis (CAMRAD) with experimental results, effects of winglets on flutter of twin-engine transport type wing]
6. Anonymous: *Research and Technology: 1984 Annual Report of the Langley Research Center*. NASA TM-86321, Nov. 1984. [body-freedom flutter of forward-swept wing, unsteady pressures and instability for DAST ARW-2 wing]
7. Anonymous: *Research and Technology: 1985 Annual Report of the Langley Research Center*. NASA TM-87623, Nov. 1985. [V-22 tiltrotor model]
8. Anonymous: *Research and Technology: 1986 Annual Report of the Langley Research Center*. NASA TM-89037, Dec. 1986. [DAST ARW-2 instability]
9. Anonymous: *Research and Technology: 1987 Annual Report of the Langley Research Center*. NASA TM-4021, Dec. 1987. [AFW active roll control]
10. Anonymous: *Research and Technology: 1988 Annual Report of the Langley Research Center*. NASA TM-4078, Dec. 1988. [DAST ARW-2 SIO]
11. Anonymous: *Research and Technology 1989—Langley Research Center.* NASA TM-4150, Feb. 1990. [composite A-6 wing flutter, reduction of rotor BVI noise using HHC]
12. Anonymous: *Research and Technology 1990—Langley Research Center.* NASA TM-4243, Feb. 1991. [AFW flutter suppression, Atlas II ground wind loads]
13. Anonymous: *Research and Technology 1991—Langley Research Center.* NASA TM-4331, Feb. 1992. [trail-rotor flutter model, NACA 0012 benchmark model, SIO research model, unstable model on two-cable mount system, data acquisition system improvements]
14. Anonymous: *Research and Technology Highlights 1992—Langley Research Center.* NASA TM-4452, Mar. 1993. [pressure measurement during flutter for NACA 0012 benchmark model, brief description of TDT as critical national facility]
15. Anonymous: *Research and Technology Highlights 1993—Langley Research Center.* NASA TM-4575, Aug. 1994. [aeroelastic response of twin-engine transport wing; flutter of business jet wing; B777 flutter model; correlation of flutter analysis and experiment for 45^0-swept wing; Citation X flutter clearance; advanced rotor blade technology, comparisons of baseline, BERP, and Blackhawk blades; brief description of TDT as critical national facility]
16. Anonymous: *Research and Technology Highlights 1994—Langley Research Center.* NASA TM-4708, Dec. 1995. [Citation X full-span flutter model, pressures on 64A010

benchmark model, pressures on HSR rigid semi-span model, F/A-18 E/F flutter clearance, correlation of flutter analysis with experimental results for business-jet wing, brief description of TDT as critical national facility]

17. Anonymous: *Research and Technology Highlights 1995—Langley Research Center*. NASA TM-4765, Dec. 1996. [active flaperon effects on vibratory loads of tiltrotor wing, Learjet Model 45 flutter-clearance]
18. Anonymous: *NASA Langley Highlights 1997*. NASA TM-1998-208451, July 1998. [aircraft morphing, semi-span Smart Wing model; F/A-18 twin tail buffet tests mentioned]
19. Anonymous: *NASA Langley Highlights 1998.* NASA TM-1999-209363, Aug. 1999. [near real time control surface deflection measurements on DARPA/Northup-Grumman Smart Wing model]

1.5 Test Highlight Reports of the Langley Research Center

1. Anonymous: *Langley Test Highlights 1981*. NASA TM-84519, May 1982. [description of facility, F-16 horizontal tail flutter clearance, YF-17 active flutter suppression, F-16E vertical tail flutter clearance, pressure measurements on high aspect supercritical wing with oscillating control surfaces]
2. Anonymous: *Langley Test Highlights 1982*. NASA TM-84655, May 1983. [description of facility, adaptive digital active flutter suppression (YF-16), oscillating rectangular supercritical wing pressure measurements, effects of changes in rotor blade tip geometry on performance and vibratory loads, F-16 active flutter suppression, F-16E flutter clearance, effects of supercritical airfoil section on transport wing flutter]
3. Anonymous: *Langley Aerospace Test Highlights 1983*. NASA TM-85806, June 1984. [description of facility, body-freedom flutter of forward-swept-wing (X-29A), winglet effects on twin-engine transport wing flutter, effects of new fuel tanks and non-jettisonable pylons on F-16 flutter (flutter clearance), decoupler pylon on F-16 model, Galileo parachutes, effects of new AMRAAM missile on F-16 flutter (flutter clearance)]
4. Anonymous: *Langley Aerospace Test Highlights 1984*. NASA TM-87585, Jan. 1985. [description of facility, effects of new multi-purpose pylons on F-16 flutter (flutter clearance), effects of spanwise curvature on wing flutter, winglet effects on four-engine transport wing flutter, JVX data base developed]
5. Anonymous: *Langley Aerospace Test Highlights 1985*. NASA TM-87703, May 1986. [description of facility, prop-fan testbed aircraft flutter clearance, active control of DAST ARW-2, upgraded Blackhawk (UH-60) rotor performance]
6. Anonymous: *Langley Aerospace Test Highlights 1986*. NASA TM-89144, May 1987. [description of facility, F-16 adaptive flutter suppression, AFW, active control of DAST ARW-2 (SIO), new composite A-6 wing (flutter clearance)]
7. Anonymous: *Langley Aerospace Test Highlights 1987*. NASA TM-100595, May 1988. [description of facility, F-16 adaptive flutter suppression system, effects of speed brakes on wing flutter, empennage buffeting of twin-vertical-tail configuration, helicopter blade/vortex interaction (BVI) noise reduction]
8. Anonymous: *Langley Aerospace Test Highlights 1988*. NASA TM-101579, May 1989. [description of facility, microphone frequency response in heavy gas, effects of new leading-edge flaps and air defense pylons on F-16 flutter (flutter clearance), MILSTAR ra-

dome panel flutter, Atlas-Centaur large payload fairing aeroelastic effects; performance of advance-design helicopter rotor blades]

9. Anonymous: *Langley Aerospace Test Highlights 1989*. NASA TM-102631, May 1990. [leading-edge curvature effects on swept wing flutter, aileron-buzz of generic NASP model, AFW active flutter suppression, rotorcraft vibration reduction by use of nonstructural mass, higher-harmonic pitch control to reduce rotor impulsive (BVI) noise, Atlas II ground wind loads]
10. Anonymous: *Langley Aerospace Test Highlights 1990.* NASA TM-104090, May 1991. [description of facility, A-12 flutter clearance, flutter characteristics of trail-rotor model, aeromechanical stability of hingeless rotors, statically unstable model on two-cable mount system, NACA 0012 benchmark model test, SIO of flexible research wing]

2.0 FACILITY, TEST EQUIPMENT, TEST TECHNIQUES, AND CALIBRATIONS

2.1 Facility

1. Anonymous: *Study of Methods of Improving the Performance of the Langley Research Center Transonic Dynamics Tunnel (TDT).* NASA-CR-132378 (Sverdrup & Parcel and Associates, Inc. Contract NAS1-11687), June 1973. [examines possible methods for increasing the dynamic pressure range and maximum Mach number]
2. Anonymous: *Research and Test Facilities.* Technology Opportunities Show Case, NASA TM-109685, Jan. 1993. [description of facility and guidance for perspective users]
3. Baals, Donald D.; and Corliss, William R.: *Wind Tunnels of NASA.* NASA SP-440. 1981. [descriptions of TDT and the 19-Foot Pressure Tunnel from which the TDT was converted]
4. Cole, Stanley R.; Johnson, R. Keith; Piatak, David J.; Florance, Jennifer P.; Rivera, José A., Jr.: *Test Activities in the Langley Transonic Dynamics Tunnel and a Summary of Recent Facility Improvements*. AIAA Paper 2003-1958, 44th AIAA/ASME/ASCE/AHS Structures, Structural Dynamics, and Materials Conference, Norfolk, VA, Apr. 7-10, 2003. [test activities discussed include MER parachute, Mars scout vehicle, free-to-roll testing, and circulation control airfoil; facility improvements described include conversion from Freon to R134a test medium, improvements to the gas processing system, oscillating turntable (OTT) apparatus, new model preparation area]
5. Cole, Stanley R.; and Garcia, Jerry L.: *Past, Present, and Future Capabilities of the Transonic Dynamics Tunnel from an Aeroelasticity Perspective.* AIAA Paper 2000-1767, 41st AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Atlanta, GA, Apr. 3-6, 2000. [review of characteristics of facility with emphasis on those applicable to aeroelastic testing]
6. Cole, Stanley R.; and Rivera, José A., Jr.: *The New Heavy Gas Testing Capability in the NASA Langley Transonic Dynamics Tunnel.* Paper No. 4, Royal Aeronautical Society Wind Tunnels and Wind Tunnel Test Techniques Forum, Churchill College, Cambridge, UK, Apr. 14-16, 1997. (Also available as NASA TM-112702, Jan. 1997) [after conversion to R134a test medium]
7. Corliss, James M.; and Cole, Stanley R.: *Heavy Gas Conversion of the NASA Langley Transonic Dynamics Tunnel.* AIAA Paper 1998-2710, 20th AIAA Advanced Measure-

ment and Ground Testing Technology Conference, Albuquerque, NM, June 15-18, 1998. [conversion from Freon 12 to R134a test medium]

8. Hanson, Perry W.: *An Assessment of the Future Role of the National Transonic Facility and the Langley Transonic Dynamics in Aeroelastic and Unsteady Aerodynamic Testing.* NASA TM-81839, June, 1980. [compares characteristics of the two facilities and discusses the suitability of the National Transonic Facility for aeroelastic testing]
9. Ivanco, Thomas G.: *Unique Testing Capabilities of the NASA Langley Transonic Dynamics Tunnel, an Exercise in Aeroelastic Scaling.* AIAA Paper 2013-2625, AIAA Fluid Dynamics Conference and Exhibit, San Diego, CA, June 24-27, 2013. [focuses on scaling aeroelastic model for TDT testing]
10. Kvaternik, Raymond G.: *Computer Programs for Calculating the Isentropic Flow Properties for Mixtures of R-134a and Air.* NASA TM-2000-210622, Nov. 2000. [method for determining Mach number, density, velocity, and other test properties]
11. Schaefer, William T., Jr.: *Characteristics of Major Active Wind Tunnels at the Langley Research Center.* NASA-TM-X-1130, July 1965. [useful in comparing TDT characteristics with those of other major LaRC wind tunnels]
12. Staff of the Aeroelasticity Branch: *The Langley Transonic Dynamics Tunnel*. NASA Langley Working Paper (LWP)-799, Sep. 1969. [This report served for years as the basic reference manual for the TDT—much of it is still applicable.]

2.2 Test Equipment

1. Abbott, Frank T., Jr.: *Brief Description of the Characteristics of the Langley Transonic Dynamic Tunnel Airstream Oscillator.* Meeting on Aircraft Response to Turbulence, NASA TM-83240, 1968, pp. 6.1-6.11. [bi-plane oscillating vane system, gust generator]
2. Barbero, P.; and Chin, J.: *User's Guide for a Computer Program to Analyze the LRC 16' Transonic Dynamics Tunnel Cable Mount System*. NASA CR-132313, Jan. 1973. [used to determine stability of models mounted on standard two-cable mount system]
3. Bruce, Robert A.; Hess, Robert W.; and Rivera, J. A.; *A Vapor Generator for Transonic Flow Visualization.* NASA TM-101670, Oct. 1989. [propylene glycol system for flow visualization]
4. Bryant, Charles S.; and Hoadley, Sherwood T.: *Open Architecture Dynamic Data System at Langley's Transonic Dynamics Tunnel.* AIAA Paper 1998-0343, 36th AIAA Aerospace Sciences Meeting and Exhibit, Reno, NV, Jan. 12-15, 1998. [Open Architecture Data Acquisition System (OADAS) replacement for Data Acquisition and Monitoring Program (DAMP)]
5. Chin, J.; and Barbero, P.: *User's Guide for a Revised Computer Program to Analyze the LRC Transonic Dynamics Tunnel Active Cable-Mount System*. NASA CR-132692, July 1975. [used to determine stability of models mounted on active-control version of two-cable mount system]
6. Cole, Patricia H.: *Real-Time Data Acquisition System for the NASA Langley Transonic Dynamics Tunnel.* 25th International Instrumentation Symposium, Anaheim, CA, May 7-10, 1979. (Substantially the same paper available as: *Wind Tunnel Real-Time Data Acquisition System*. NASA TM-80081, 1979.) [description of Sigma 5 data acquisition system]

7. Doggett, Robert V., Jr.; and Ricketts, Rodney H.: *Aeroelastic Instability Stoppers for Wind Tunnel Models.* United States Patent 4,372,158, Feb. 8, 1983. [constraining device]
8. Doggett, Robert V., Jr.; and Ricketts, Rodney H.: *Aeroelastic Instability Stoppers for Wind Tunnel Models.* United States Patent 4,372,159, Feb. 8, 1983. [flow diverting device]
9. Doggett, Robert V., Jr.; Rosser, David C., Jr.; and Bryant, Charles S.: *Data Acquisition for Aeroelastic Testing at the NASA Langley Transonic Dynamics Facility.* Proceeding of the 39th International Instrumentation Symposium, Albuquerque, NM, May 3-6, 1993. [describes ModComp data acquisition system, replacement for Sigma 5 system]
10. Duncan, R. L.; and Reed, W. H., III.: *Dampers to Suppress Wind-Induced Oscillations of Tall Flexible Structures.* 10th Midwestern Mechanics Conference, Ft. Collins, CO., Aug. 21-23, 1967. (Also available as NASA-TM-X-60432, Jan. 1967.) [viscous dampers]
11. Farmer, Moses G.: *A Two-Degree-of-Freedom Flutter Mount System with Low Damping for Testing Rigid Wings at Different Angles of Attack*. Virginia Academy of Science Meeting, Blacksburg, VA, Apr. 20-23, 1982. (Also available as NASA TM-83302, Apr. 1982). [PAPA]
12. Farmer, Moses G.: *Mount System for Testing Flutter.* U. S. Patent No. 4,475,385, Oct. 9, 1984. [PAPA]
13. Flagge, Bruce: *Long-Life Electromechnaical Sine-Cosine Generator*. NASA Tech Brief, Mar. 1971. [signal generator for use with model test equipment]
14. Hanson, Perry W.: *Lift-Balancing Device*. United States Patent 3,695,101, Oct. 3, 1972. [for use in conjunction with the two-cable mount system to test models in lifting conditions]
15. Loftin, Laurence K., Jr.: *Wind Tunnel Airstream Oscillating Apparatus.* United States Patent 3,005,339, Oct. 14, 1961. [bi-plane oscillating vane system, gust generator]
16. Reed, Wilmer H., III; and Abbott, Frank T., Jr.: *A New "Free-Flight" Mount System for High-Speed Wind-Tunnel Flutter Models.* Proceedings of Symposium on Aeroelastic and Dynamic Modeling Technology, RTD-TDR-63-4197, Part I, Mar. 1964, pp. 169-206. [original two-cable mount system, simulation of free flight]
17. Reed, Wilmer H., III: *Test Unit Free-Flight Suspension System.* United States Patent 3,276,251, Oct. 4, 1966. [original two-cable mount system, simulation of free flight]
18. Piatak, David J.; and Kunz Donald L.: *An Experimental Testbed for Investigations of Tiltrotor Vibration Control.* Technical Note, Journal of the AHS, Vol. 45, No. 4, Oct. 2000, pp. 280-283. [WRATS]
19. Piatak, David J.; and Cleckner, Craig S.: *Oscillating Turntable for the Measurement of Unsteady Aerodynamic Phenomena.* Journal of Aircraft, Vol. 40, No. 1, Jan.-Feb. 2003, pp. 181-188. (Originally AIAA Paper 2002-0171, AIAA 40th Aerospace Sciences meeting and Exhibit, Reno, NV, Jan. 2002.) [sidewall turntable]
20. Piatak, David J.: *WRATS Integrated Data Acquisition System.* NASA Tech Briefs, Mar. 2008, pp. 5-6.

21. Sorokach, Michael R., Jr.: *Miniature Linear-to-Rotary Motion Actuator.* 27th Aerospace Mechanism Symposium, NASA Ames Research Center, Moffitt Field, CA, May 12-14, 1993, NASA CP-3205, 1993, pp. 299-314. [for use on active control models]
22. Schuster, David M.: *Aerodynamic Measurements on a Large Splitter Plate for the NASA Langley Transonic Dynamics Tunnel.* NASA TM-2001-210828, Mar. 2001. [splitter plate mounted off of wind-tunnel sidewall]
23. Wieseman, Carol D.; and Hoadley, Sherwood T.: *Versatile Software Package for Near Real-Time Analysis of Experimental Data.* 20th AIAA Advanced Measurement and Ground Testing Technology Conference, Albuquerque, NM, June 15-18, 1998. [specifically developed for TDT, but applicable to other facilities]
24. Wilbur, Matthew L.: *Application of a PC-Based, Real-Time, Data-Acquisition System in Rotorcraft Wind-Tunnel Testing.* NASA TM-4119 and U. S. Army AVSCOM TM-89-B-003, July, 1989. [system components include IBM Personal Computer AT (PC-AT) and an Omega Engineering OM-900 Stand-Alone Interface System, provides high speed data acquisition for a limited number of channels]

2.3 Test Techniques

1. Abbott, Frank T., Jr.: *Some Current Techniques in Experimental Aeroelasticity*. Symposium on Solid-Fluid Interaction Problems in Mechanics, ASME 1867 Winter Annual Meeting, Pittsburgh, PA, Nov. 12-16, 1967. (Also available as NASA-TM-X-60862, 1967.) [an overview of many different contemporary test techniques employed in the TDT]
2. Abel, Irving: *A New Wind-Tunnel Technique for the Measurement of Various Aircraft Stability Derivatives.* NASA TM-X-61518, June 1968. [an adaptation of two-cable mount system]
3. Abel, Irving: *Evaluation of a Technique for Determining Airplane Aileron Effectiveness and Roll Rate by Using an Aeroelastically Scaled Model.* NASA TN D-5538, Nov. 1969. [an adaptation of two-cable mount system]
4. Bennett, R. M.: *Application of Zimmerman Flutter-Margin Criterion to a Wind Tunnel Model.* NASA TM-84545, Nov. 1982. [subcritical response flutter prediction technique applied to simplified model of DAST ARW-2 wing of spar/ segmented-pod construction]
5. Bennett, Robert M.; Farmer, Moses G.; Mohr, Richard L.; and Hall, W. Earl, Jr.: *Wind-Tunnel Technique for Determining Stability Derivatives from Cable-Mounted Models.* Journal of Aircraft, Vol. 15, No. 5, May 1978, pp. 304-310. (Originally AIAA Paper 1977-1128, AIAA Atmospheric Flight Mechanics Conference, Hollywood, FL, Aug. 8-10, 1977.) [system identification scheme]
6. Burner, A. W.; and Martinson, S. D.: *Automated Wing Twist and Bending Measurements Under Aerodynamic Loads.* AIAA Paper 1996-2253, 19th AIAA Advanced Measurement and Ground Testing Technology Conference, New Orleans, LA, June 17-20, 1996. [video camera and frame grabber interfaced to computer]
7. Burner, A. W.; Wahls, R. A.; Owens, L. R.; and Goad, W. K.: *Model Deformation Measurement Technique—NASA Langley HSR Experiences.* First NASA/Industry High-Speed Research Configuration Aerodynamics Workshop, Langley Research Center Hampton, VA, Feb. 27-29, 1996, NASA/CP-1999-209690/PT2, Dec. 1999, pp. 561-578. [mentions studies made at TDT and other LaRC wind tunnels]

8. Byrdsong, Thomas A.; Adams, Richard R.; and Sandford, Maynard C.: *Close-range Photogrammetry Measurement of Static Deflections for an Aeroelastic Supercritical Wing.* NASA TM-4194, Dec. 1990. [DAST ARW-2 right wing mounted to rigid half-body fuselage]
9. Doggett, Robert V., Jr.; and Hammond, Charles E.: *Application of Interactive Computer Graphics in Wind-Tunnel Dynamic Model Testing.* Conference on Applications of Computer Graphics in Engineering, NASA Langley Research Center, Hampton, VA, Oct. 1-2, 1975, NASA SP-390, pp. 325-353. [thorough description of Sigma 5 data acquisition system and illustrative applications of applying computerized subcritical response methods to flutter onset prediction]
10. Doggett, Robert V., Jr.: *Some Observations on the Houbolt-Rainey and Peak-Hold Methods of Flutter Onset Prediction.* NASA TM-102745, Nov. 1990. [shows relationship between two flutter onset prediction methods, illustrative subcritical flutter response data from tests of low-aspect-ratio delta wings]
11. Fleming, Gary A.; Soto, Hector L.; and South, Bruce W.: *Projection Moiré Interferometry for Rotorcraft Applications: Deformation Measurement of Active Twist Rotor Blades.* 58th AHS Annual Forum, Montréal, Canada, June 11-13, 2002. [methodology has general applicability]
12. Gilman, Jean, Jr.; and Bennett, Robert M.: *A Wind-Tunnel Technique for Measuring Frequency-Response Functions for Gust Load Analysis.* Journal of Aircraft, Vol. 3, No. 6, Nov.-Dec. 1966, pp. 535-540. (Originally AIAA Paper 1965-787, AIAA/RAeS/JSASS Aircraft Design and Technology Meeting, Los Angeles, CA, Nov. 15-18, 1965. [application of bi-plane oscillating vane system, gust generator]
13. Hammond, Charles E.; and Doggett, Robert V., Jr.*: Determination of Subcritical Damping by Moving-Block/Randomdec Applications.* Symposium on Flutter Testing Techniques, Dryden Flight Research Center, Edwards, CA, Oct. 9-10, 1976, NASA SP-415, pp. 59-76, 1976. [brief description of Sigma 5 data acquisition system and applications of subcritical response methods to flutter onset prediction]
14. Hanson, Perry W. *Evaluation of an Aeroelastic Model Technique for Predicting Airplane Buffet Loads*. NASA TN D-7066, 1973. [application of lift counter balancing device to testing F-111 model]
15. Hanson, Perry W.; and Jones, George W., Jr.: *The Use of Dynamic Models for Studying Launch Vehicle Buffet and Ground-Wind Loads.* Symposium on Aeroelastic and Dynamic Modeling Technology, RTD-TDR-63-4197, Part I, Mar. 1964. [reviews contemporary uses of dynamic models]
16. Heeg, Jennifer; Spain, Charles V.; and Rivera, J. A.: *Wind Tunnel to Atmospheric Mapping for Static Aeroelastic Scaling.* AIAA Paper 2004-2044, 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Palm Springs, CA, Apr. 19-22, 2004. [scaling and testing of aeroelastic models]
17. Heeg, Jennifer: *Stochastic Characterization of Flutter Using Historical Wind Tunnel Data.* AIAA Paper 2007-1769, 48th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Honolulu, HI, Apr. 23-26, 2007. [nondeterministic approach to flutter onset prediction, illustrated using PARTI model data]

18. Mohr, Richard L.; and Hall, W. Earl, Jr.: *Identification of Stability Derivatives from Wind Tunnel Tests of Cable Mounted Aeroelastic Models.* NASA CR-145123, 1977. [system identification scheme]

19. Rainey, A. G.; and Abel, I.: *Wind-Tunnel Techniques for the Study of Aeroelastic Effects on Aircraft Stability, Control, and Loads.* AGARD Aeroelastic Effects from a Flight Mechanics Standpoint, AGARD CP-46 Mar. 1970, pp. 18.1-18.15. (Paper presented at 34th Meeting of the AGARD Flight Mechanics Panel, Marseilles, France, Apr. 21-24, 1969.) [biplane oscillating vane system, gust generator; two cable mount system, including roll control system and lift balancing device, control effectiveness and stability derivative measurement technique]

20. Reed, Wilmer H., III: *Comparison of Flight Measurements with Predictions from Aeroelastic Models in the NASA Langley Transonic Dynamics Tunnel*. Proceedings of 46th AGARD Conference on Flight/Ground Testing Facilities Correlation, AGARD CP-187, Valloire, Savoie, France, June 9-12, 1975. (Also available as NASA TM-X-72686, May 1975.) [B-52 CCV model flutter and gust response, C-141T-tail flutter model, C-5A model with Active Lift Distribution Control System (ALDCS)]

21. Reed, Wilmer H., III: *Models for Obtaining Effects of Ground Winds on Space Vehicles Erected on the Launch Pad.* Conference on the Role of Simulation in Space Technology, Virginia Polytechnic Institute, Engineering Extension Series, Circular No. 4, Part C., Paper XVIII, Aug. 17-21, 1964. [reviews then current test techniques and presents methods for interpreting data]

22. Runyan, H. L.; Morgan, H. G.; and Mixon, J. S.: *Use of Dynamic Models in Launch-Vehicle Development.* 18th Meeting Structures and Materials Panel—AGARD, Liege, Belgium, May 1964. [comparison of TDT model and full-scale ground-wind-loads data for Scout launch vehicle]

23. Ruhlin, C. L.; Watson, J. J.; Ricketts, R. H.; and Doggett, R. V., Jr.: *Evaluation of Four Subcritical Response Methods for On-Line Prediction of Flutter Onset in Wind-Tunnel Tests*. Journal of Aircraft, Vol. 20, No. 10, Oct. 1983, pp. 835-840. (Originally AIAA Paper 1982-0644, 23rd AIAA/ASME/ASCE/AHS Structures, Structural Dynamics, and Materials Conference, New Orleans, LA, May 10-12, 1982; and NASA TM-83278, Mar. 1982.) [random decrement (Randomdec), power-spectral density, peak-hold, and cross-spectrum methods]

24. Soistmann, David L.: *Cable-Mount Stability Analysis for the SST Active Controls Testbed Model.* Lockheed-Martin Engineering Services, AOSR 95-04, July 1995. [determination of model stability on two-cable mount system prior to wind-on testing]

25. Spain, Charles V.; Heeg, Jennifer; Ivanco, Thomas G.; Barrows, Danny A.; Florence, James R.; Burner, Alpheus W.; DeMoss, Joshua; and Lively, Peter S.: *Assessing Videogrammery for Static Aeroelastic Testing of a Wind-Tunnel Model.* AIAA Paper 2004-1677, 45th AIAA/ASME/ASCE/ ASHS/ASC Structures, Structural Dynamics, and Materials Conference, Palm Springs, CA, Apr. 19-20, 2004. [model deformation measurement system applied to variable-stiffness spar model, a semi-span configuration based on F/A-18A]

26. Tomek, Deborah M.; Sewall, William G.; Mason, Stan E.; and Szchur, Bill W. A.: *The Next Generation of High-Speed Dynamic Stability Wind Tunnel Testing (Invited).* AIAA Paper 2006-3148, 25th AIAA Aerodynamic Measurement Technology and Ground Test-

ing Conference, San Francisco, CA, June 5-8, 2006. [technique for measuring dynamic stability derivatives outside of the low-speed regime, non-aeroelastic testing capability]

25. Wiley, H. G.; Kilgore, Robert A.; Gilman, J., Jr.: *Some Recent Developments of Dynamics Techniques for Wind Tunnels.* Conference on Aircraft Aerodynamics, NASA-SP-124, May 1966, pp. 45-59. [with respect to TDT, use of bi-plane oscillating vane system in gust studies]

2.4 Calibrations

1. Dougherty, N. Sam, Jr.: *Influence of Wind Tunnel Noise on the Location of Boundary-Layer Transition on a Slender Cone at Mach Numbers from 0.2 to 5.5. Volume I Experimental Methods and Summary of Results.* Arnold Engineering Development Center, Arnold Air Force Station, TN, AEDC-TR-78-44, Mar. 1980. [flow turbulence]
2. Dougherty, N. Sam, Jr.: *Influence of Wind Tunnel Noise on the Location of Boundary-Layer Transition on a Slender Cone at Mach Numbers from 0.2 to 5.5. Volume II Tabulated and Plotted Data*. Arnold Engineering Development Center, Arnold Air Force Station, TN, AEDC-TR-78-44, Mar. 1980. [flow turbulence]
3. Krynytzky, A. J.: *Steady-State Wall Interference of a Symmetric Half-Model in the Langley Transonic Dynamics Tunnel.* AIAA Paper 2001-16082, 39th AIAA Aerospace Sciences meeting and Exhibit, Reno, NV, Jan. 8-11, 2001. [transport type swept wing mounted on half body]
4. Florance, James R.; and Rivera, José A., Jr.: *Sidewall Mach Number Distribution for the NASA Langley Transonic Dynamics Tunnel.* NASA TM-2001-211019, June 2001. [after conversion to R134a test medium]
5. Lee, In: *Resonance Prediction for Slotted Wind Tunnel by the Finite Element Method.* AIAA Paper 1986-0898, 27th AIAA Structures, Structural Dynamics, and Materials Conference, San Antonio, TX, May 18-21, 1986. [application to TDT and other wind tunnels]
6. Mirick, Paul H.; Hamouda, M-Nabil; and Yeager, William T., Jr.: *Wind-Tunnel Survey of an Oscillation Flow Field for Application to Model Helicopter Rotor Testing.* NASA TM-4224 and U. S. Army AVSCOM-TR-90-B-007, Dec. 1990. [gust field generated by bi-plane oscillating vanes in region of test section where helicopter models are mounted]
7. Piatak, David J.: *Survey of Primary Flow Measurement Parameters at the NASA Langley Transonic Dynamics Tunnel.* NASA TM-2003-212413, June 2003. [after conversion to R134a test medium]
8. Sleeper, Robert K.; Keller, Donald F.; Perry, Boyd, III; and Sandford, Maynard C.: *Characteristics of Vertical and Lateral Tunnel Turbulence Measured in Air in the Langley Transonic Dynamics Tunnel*. NASA TM-107734, Mar. 1993. (Similar information is contained in: Sleeper, Robert K.; Keller, Donald F.; Perry, Boyd, III; and Sandford, Maynard C.: *Measurement of Air Turbulence in the Langley Transonic Dynamics Tunnel (TDT) Using an Anemometer Equipped with a Hot-Film X Probe.* ASME Fluid Measurements and Instrumentation Forum-1993, FED-Vol. 161, June 1993, pp. 75-78.) [turbulence in tunnel test section during operations in air]
9. Wieseman, Carol D.; and Sleeper, Robert K.: *Measurement of Flow Turbulence in the NASA-Langley Transonic Dynamics Tunnel.* NASA TM-2005-213529, Feb. 2005. [test-section measurements after conversion to R-134A test medium]

10. Wieseman, Carol D.; and Bennett, Robert M.: *Wall Boundary Layer Measurements for the NASA Langley Transonic Dynamics Tunnel.* NASA TM-2007-214867, Mar. 2007. [test-section boundary layer, after conversion to R-134A test medium]
11. Yeager, William T., Jr.; Wilbur, Matthew L.; Mirick, Paul H.; and Rivera, José A.: *Flow Angularity Measurements in the NASA-Langley Transonic Dynamics Tunnel.* NASA TM-2005-213946 and U. S. Army ARL-TR-3691, Dec. 2005. [test-section flow angularity measured with survey rake having eleven five-hold pyramid-head probes]

3.0 AIRPLANES

3.1 Surveys/Overviews

1. Cole, Stanley R.; Noll, Thomas E.; and Perry, Boyd, III: *Transonic Dynamics Tunnel Aeroelastic Testing in Support of Aircraft Development.* Journal of Aircraft, Vol. 40, No. 5, Sep.-Oct. 2003, pp. 820-842. [summary of tests conducted up to year 2003]
2. Rivera, José A.; and Florance, James R.: *Contribution of Transonic Dynamics Tunnel Testing to Airplane Flutter Clearance.* AIAA Paper 2000-1768, AIAA Dynamics Specialists Conference, Atlanta, GA, Apr. 5-6, 2000. [summary of tests conducted up to year 2000]

3.2 Civil Transports

1. Abbott, Frank T., Jr.; Kelly, H. Neale, and Hampton, Kenneth D.: *Investigation of the 1/8-Size Dynamic-Aeroelastic Model of the Lockheed Electra Airplane in the Langley Transonic Dynamics Tunnel*. NASA TM SX-456, Nov. 1960. [propeller whirl flutter, Lockheed Electra model test, report prepared for the Federal Aviation Administration]
2. Abbott, Frank T., Jr.; Kelly, H. Neale; and Hampton, Kenneth D.: *Investigation of Propeller-Power Plant Autoprecession Boundaries for a Dynamic-Aeroelastic Model of a Four-Engine Turboprop Transport Airplane.* NASA TN D-1806, Aug. 1963. [propeller whirl flutter, most comprehensive report describing Lockheed Electra model tests]
3. Allen, Timothy J.; Sexton, Bradley W.; and Scott, Matthew J.: *SUGAR Truss Braced Wing Full Scale Aeroelastic Analysis and Dynamically Scaled Wind Tunnel Model Development.* AIAA paper 2015-1171, 56th AIAA/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Kissimmee, FL, Jan. 5-9, 2015. [Subsonic Ultra Green Aircraft Research Program (SUGAR), aeroelastic analysis and tests]
4. Bennett, Robert M.; Kelly, H. Neale; and Gurley, John D.: *Investigation of 1/8-Size Dynamic-Aeroelastic Model of the Lockheed Electra Airplane in the Langley Transonic Dynamics Tunnel*. NASA TM-SX-818, Apr. 1963. [propeller whirl flutter, report prepared for the Federal Aviation Agency (FAA)]
5. Bhatia, K. G.; and Nagaraja, K. S.: *Flutter Parametric Studies of Cantilevered Twin-Engine Transport-Type Wing Models With and Without Winglets, Volume II—Transonic and Density Effect Investigations*. NASA CR-172410-VOL 2, Sep. 1984. [B767-like wing model]
6. Bhatia, K. G.; Nagaraja, K. S.; and Ruhlin, C. L.: *Winglet Effects on the Flutter of Twin-Engine Transport-Type Wing*. Journal of Aircraft, Vol. 22, July 1985, pp. 587-594. (Originally AIAA Paper 1984-0905, 25th AIAA/ASME/ASCE/AHS Structures, Structural Dynamics, and Materials Conference, Palm Springs, CA, May 14-16, 1984.) [B767-like wing model]

7. Bhatia, K. G.; Nagaraja, K. S.; and Ruhlin, C. L.: *Effects of Winglet on Transonic Flutter Characteristics of a Cantilevered Twin-Engine-Transport Wing Model*. NASA TP-8768, Dec. 1986. [B767-like model]
8. Farmer, Moses G.: *Flutter Studies to Determine Nacelle Aerodynamic Effects on a Fan-Jet Transport Model for Two Mount Systems and Two Wind Tunnels*. NASA TN D-6003, Sep. 1970. [747 full-span model]
9. Hajj, Muhammad F.; and Silva, Walter A.: *Nonlinear Flutter Aspects of the Flexible High-Speed Civil Transport Semispan Wing.* Journal of Aircraft, Vol. 41, Issue 5, Oct 2004, pp. 1202-1208. (Originally AIAA Paper 2003-1515 44th AIAA/ASME/ASCE/AHS Structures, Structural Dynamics, and Materials Conference, Norfolk, VA, Apr. 7-10, 2003.)
10. Jenness, C. M. J.: *Propfan Test Assessment Testbed Aircraft Flutter Model Test Report.* NASA CR-179458 (Contract NAS3-24339, Lockheed-Georgia Co.), June 1986. [flutter clearance, propfan demonstrator]
11. Rauch, Frank J.; and Clark, William B.: *Results of Test Conducted on a 1/10th Scale Flutter Model of Gulfstream G-V Wing (With Addendum A, Advanced Design Winglet)*. Gulfstream Aerospace Report #GV-GET-614, Mar. 1993. [Gulfstream, winglet effects on flutter]
12. Rauch, F. J. and Waters, C.: *Tests and Analyses of a 1/6.5-Size Flutter Model of an Executive Jet Transport Supercritical Wing With/Without Winglet, Part 1.* NASA CR-165857, Nov. 1978. [Gulfstream, winglet effects on flutter]
13. Reed, Wilmer H., III; and Bland, Samuel R.: *An Analytical Treatment of Aircraft Propeller Precession Instability*. NASA TN D-659, Jan. 1961. [theoretical study precipitated by Lockheed Electra prop-whirl flutter studies, contains some comparisons to experimental data, first publication of some Lockheed Electra model experimental flutter data]
14. Reed, Wilmer H., III; and Bennett, Robert M.: *Propeller Whirl Considerations for V/STOL Aircraft*. Proceedings CAL-TRECOM Symposium on Dynamic Loads Problems Associated with Helicopters and V/STOL Aircraft, Vol. III, Buffalo, NY, June 26-27, 1963. [sting mounted Electra nacelle and propeller]
15. Ruhlin, C. L.; Rauch, F.; and Waters, J. R.: *Transonic Flutter Study of a Wind-Tunnel Model of a Supercritical Wing With/Without Winglet.* Journal of Aircraft, Vol. 20, No. 8, Aug. 1983, pp. 711-716. (Originally AIAA Paper 1982-0721, 23rd AIAA/ASME/ASCE/AHS Structures, Structural Dynamics, and Materials Conference, New Orleans, LA, May 10-12, 1982; and NASA TM-83279, Mar. 1982.) [Gulfstream III, winglet effects on flutter]
16. Soistmann, David L.: *Ground Vibration Test of the High Speed Research Rigid Semi-Span Model.* Lockheed Martin Engineering Services, AOSR 95-06, July 1995. [HSR model]
17. Yates, E. Carson, Jr.; and Sandford, Maynard C.: *An Exploratory Investigation of the Flutter and Subcritical Frequency-Response of a Clipped-Delta Canard Surface at Mach Number Up to 0.92*. Langley Working Paper (LWP)-65. (undated, approximately 1961) [NX-2 nuclear airplane design]
18. Zhao, Wei; Kapania, Rakesh K.; Schetz, Joseph A.; and Coggin, John M.: *Nonlinear Aeroelastic Analysis of SUGAR Truss-Braced Wing Wind Tunnel Model under In-plane*

Loads. AIAA Paper 2015-1173, 56th AIAA/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Kissimmee, FL, Jan. 5-9, 2015. [Subsonic Ultra Green Aircraft Research Program (SUGAR), inplane load effects on flutter]

3.3 Military Airplanes

1. Bensinger, C. T.: *1/8 Scale FB-111 Flutter Model Test with SRAMs, 600 Gallon Tanks, and B-43, B-61, and B-57 Weapons.* FZS-126051, Contract AF33(657), General Dynamics/Ft. Worth, 17 Oct. 1969. [flutter clearance]
2. Cole, Stanley R.; Rivera, José A., Jr.; and Nagaraja, K. S.: *Flutter Study of Advanced Composite Wing with External Stores.* AIAA Paper 1987-0880, 28th AIAA/ASME/ASCE/AHS Structures, Structural Dynamics, and Materials Conference, Monterey, CA, Apr. 6-8, 1987. [new wing for A-6]
3. Chipman, R.; Rauch, F.; Rimer, M.; and Muniz, B.: *Body-Freedom Flutter of a 1/2-Scale Forward-Swept-Wing Model, An Experimental and Analytical Study.* NASA CR-172324, Apr. 1984. [1/2-scale X-29A forward swept wing (Grumman version), with and without relaxed static stability]
4. Chipman, R.; Rauch, F.; Rimer, M.; Muniz, B.; and Ricketts, R. H.: *Transonic Tests of a Forward-Swept-Wing Configuration Exhibiting Body Freedom Flutter*. AIAA Paper 1985-0689, 26th AIAA/ASME/ASCE/AHS Structures, Structural Dynamics, and Materials Conference, Orlando, FL, Apr. 15-17, 1985. [X-29A forward swept wing (Grumman design)]
5. Doggett, Robert V., Jr.; and Hanson, Perry W.: *Wind Tunnel Buffet Pressure Investigation on the Lower Nose Portion of the RF-4C Aircraft*. NASA Langley Working Paper (LWP)-227, June 1966. [addresses operational problem of reconnaissance version of airplane encountered during Vietnam War]
6. Ellis, J. W.; Dobbs, S. K.; and Miller G. D.: *Structural Design and Wind Tunnel Testing of a Forward Swept Fighter Wing.* AFWAL-TR-80-3073, July 1980. [X-29A forward swept wing (North American design)]
7. Foughner, Jerome T., Jr.; and Bensinger, Charles T.: *F-16 Flutter Model Studies with External Wing Stores*. Fourth JTCG/MD Aircraft/Stores Compatibility Symposium, Ft. Walton Beach, FL, Oct. 12-14, 1977. (Also available as NASA TM-74078, Oct. 1977.) [flutter clearance studies for a variety of external store combinations]
8. General Dynamics/Fort Worth Division: *1/8 Scale FB-111 Flutter Model Test with External Stores.* Report FZS-12-6025, Feb. 1968. [flutter clearance]
9. General Dynamics/Fort Worth Division: *Model and Test Information Report, 1/8 Scale FB-111 Flutter Model.* Report FZS-12-6008, Oct. 1969. Addendum III, Oct. 1, 1969. [flutter clearance model]
10. General Dynamics/Fort Worth Division: *1/8 Scale FB-111 Flutter Model Test with SRAMs, 600 Gallon Tanks, and B-43, B-61, and B-57 Weapons.* Report FZS-12-6051, Oct. 17, 1969. [flutter clearance]
11. Ruhlin, Charles L.; and Sandford, Maynard C.: *Experimental Parametric Studies of Transonic T-Tail Flutter.* NASA TN D-8066, Dec. 1975. [1/13-size model of C-141 T-tail]

12. Ruhlin, Charles L.; Sandford, Maynard C.; and Yates, E. Carson, Jr.: *Wind-Tunnel Flutter Studies of the Sweptback T-Tail of a Large Multijet Cargo Airplane at Mach Numbers to 0.90*. NASA TN D-2179, Mar. 1964. [C-5 flutter clearance]
13. Sandford, Maynard C.; Ruhlin, Charles L; and Yates, E. Carson, Jr.: *Subsonic and Transonic Flutter and Flow Investigations of the T-Tail of a Large Multijet Cargo Airplane.* NASA TN D-4316, Feb. 1968. (Preliminarily released as Langley Working Paper (LWP)-23, July, 1964) [C-5 flutter clearance]
14. Sandford, Maynard C.; and Ruhlin, Charles L.: *Wind-Tunnel Study of Deflected-Elevator Flutter Encountered on a T-Tail Airplane.* NASA TN D-5024, Feb. 1969. [C-141]
15. Staff of the NASA Research Center: *Summary of NASA Support of the F-111 Development Program. Part 1: December 1962-December 1963.* NASA Langley Working Paper LWP-246, Oct. 1966. [contains summaries of TDT tests conducted during the referenced time span]
16. Thompson, Nancy; and Farmer, Moses G.: *Stability Analysis of an F/A-18 E/F Cable Mount Model.* NASA TM-108989, June 1984. [flutter clearance model]
17. Wilkinson, K.; and Rauch, F.: *Predicted and Measured Divergence Speeds of an Advanced Composite Forward Swept Wing Model.* AFWAL-TR-80-3059, July 1980. [X-29A forward swept wing (Grumman design)]

3.4 Active and Passive Control of Aeroelastic Response/Characteristics

3.4.1 Surveys/Overviews

1. Abel, I.; Doggett, R. V., Jr.; Newsom, J. R.; and Sandford, M. C.: *Dynamic Wind-Tunnel Testing of Active Controls by the NASA Langley Research Center*. AGARD Ground and Flight Testing for Aircraft Guidance and Control, AGARDograph No. 262, pp. 3-1–3-23, Dec. 1984. [B-52 CCV model, delta-wing flutter suppression, DAST ARW-1 wing model, F-16 and YF-17 model studies]
2. Abel, I.; and Newsom, J. R.: *Overview of Langley Activities in Active Controls Research.* Joint Automatic Control Conference, Charlottesville, VA, June 18-19, 1981. (Available as NASA TM-83149, June 1981. [delta wing, F-16, YF-16, and DAST ARW-1 flutter suppression models; C-5A model with Active Lift Distribution Control System (ALDCS); B-52 CCV model]
3. Abel, I.; and Sandford, M. C.: *Status of Two Studies on Active Control of Aeroelastic Response at NASA Langley Research Center.* AGARD Active Control Systems for Load Alleviation, Flutter Suppression and Ride Control, AGARD-AG-175, Jan. 1974, pp. 23-48. (Also available as NASA TM-X-2909, Sep. 1973.) [delta-wing flutter suppression model, B-52 CCV model]
4. Doggett, Robert V., Jr.; Abel, Irving; and Ruhlin, Charles L.: *Some Experiences Using Wind-tunnel Models in Active Control Studies.* Symposium on Advanced Control Technology and Its Potential for Future Transport Aircraft, Los Angeles, CA, July 9-11, 1974. (Proceeding published as NASA TM-X-3409, Aug. 1976.) [clipped delta-wing flutter suppression model, B-52 CCV model, C-5A model with Active Lift Distribution Control System (ALDCS)]
5. Hanson, Perry W.: *An Aeroelastician's Perspective of Wind Tunnel and Flight Experiences with Active Control of Structural Response and Stability.* NASA TM-85761, Apr. 1984. [clipped delta wing flutter suppression model, B-52 CCV model, C-5A model with

Active Lift Distribution Control System (ALDCS), F-16 flutter suppression, YF-17 flutter suppression, simplified DAST ARW-1 wing, helicopter HHC]

6. Mukhopadhyay, Vivek: *Historical Perspective on Analysis and Control of Aeroelastic Responses.* Journal of Guidance, Control, and Dynamics, Vol. 26, No. 5. Sep.-Oct. 2003, pp. 673-684. [AAW, AFW, BACT, Smart Wing]
7. Newsom, J. R.; and Abel, I.: *Experiences with the Design and Implementation of Flutter Suppression Systems.* NASA Aircraft Controls Research 1983, Proceeding of a Workshop Held at the NASA Langley Research Center, Hampton, VA, Oct., 25-27, 1983, NASA CP-2296, 1984, pp. 489-508. [clipped delta wing model, B-52 CCV model, F-16 model, YF-17 model, simplified DAST ARW-1 wing model]
8. Noll, T.; Perry, B., III; and Kehoe, M.: *A Quarter Century of NASA Wind-Tunnel and Flight Experiments Involving Aeroservoelasticity.* 80th Meeting of the AGARD Structures and Materials Panel, Specialist's Meeting on Advanced Aeroservoelastic Testing and Data Analysis, Rotterdam, The Netherlands, May 8-10, 1995. [B-52 CCV model, F16 and YF-16 active flutter suppression models, and AFW model]
9. Perry, Boyd; Noll, Thomas E., and Scott, Robert C.: *Contributions of the Transonic Dynamics Tunnel to Testing of Active Control of Aeroelastic Response.* AIAA Paper 2000-1769, AIAA Dynamics Specialists Conference, Atlanta, GA, Apr. 5-6, 2000. [delta wing flutter suppression, C-5A Active load Alleviations System, B-52 CCV, YF-17 with stores active flutter suppression, spar and segmented-pod DAST wing, F-16 with stores active flutter suppression, AFW, PARTI, SST active controls testbed, and active control of vertical tail buffeting]

3.4.2 Active Control

3.4.2.1 Various Studies

1. Abel, Irving: *An Analytical Technique for Predicting the Characteristics of a Flexible Wing Equipped with an Active Flutter-Suppression System and Comparison with Wind-Tunnel Data.* NASA TP-1367, Feb. 1979. [experimental results from delta-wing flutter suppression model, comparisons of theory with experiment]
2. Adams, William M., Jr.; Tiffany, Sherwood H.; and Bardusch, Richard E.: *Active Suppression of an "Apparent Shock Induced Instability."* AIAA Paper 1987-0881, 28th AIAA/ASME/ASCE/AHS Structures, Structural Dynamics, and Materials Conference, Monterey, CA, Apr. 6-8, 1987. [high aspect ratio transport wing]
3. Bradley, Marty K.; Allen, Timothy J.; and Droney, Christopher: *Subsonic Ultra Green Aircraft Research: Phase II-Volume I-Truss Braced Wing Design Exploration.* NACA CR-2015-218704 (Vol. I), Jan. 2015. [Subsonic Ultra Green Aircraft Research Program(SUGAR), basic flutter and active flutter suppression,]
4. Bradley, Marty K.; Allen, Timothy J.; and Droney, Christopher: *Subsonic Ultra Green Aircraft Research: Phase II-Volume III-Truss Braced Wing Aeroelastic Test Report.* NACA CR-2015-218704 (Vol. III), Jan. 2015. [Subsonic Ultra Green Aircraft Research Program (SUGAR), basic flutter and active flutter suppression]
5. Eckstrom, Clinton V.; Seidel, David A.; and Sandford, Maynard C.: *Unsteady Pressure and Structural Response Measurements of an Elastic Supercritical Wing.* AIAA Paper 1988-2277, 29th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Williamsburg, VA, 18-20, Apr. 1988. (Also available as NASA

TM-100591, May, 1988.) [shock induced oscillation (SIO) study, DAST ARW-2 right wing]

6. Florance, Jennifer P.; Burner, Alpheus W.; Fleming, Gary A.; Hunter, Craig A.; Graves, Sharon S.; and Martin, Christopher A.: Contributions of the NASA Langley Research Center to the DARPA/AFRL/NASA/Northrop Grumman Smart Wing Program. AIAA Paper 2003-1961, 44th AIAA/ASME/ASCE/AHS Structures, Structural Dynamics, and Materials Conference, Norfolk, VA, Apr. 7-10, 2003.
7. Heeg, J.; McGowan, A-M. R.; Crawley, E. F.; and Lin, C. Y.: *The Piezoelectric Aeroelastic Response Tailoring Investigation: Analysis and Open-Loop Testing.* CEAS International Forum on Aeroelasticity and Structural Dynamics, Manchester, UK, June 1985.
8. Kudva, Jayanth N.; Martin, Christopher A.; Scherer, Lewis B.; Jardine, A. Peter; McGowan, Anna-Maria Rivas; Lake, Renee C.; Sendeckyj, George P.; and Sanders, Brian P.: *Overview of the DARPA/AFRL/NASA Smart Wing Program.* Proceedings of the Proceeding of SPIE’s 1999 Symposium on Smart Structures and Materials, Newport Beach, CA, Vol. 3674, pp. 230-236, Mar. 1999.
9. Kudva, Jayanth N; Sanders, Brian P.; Pinkerton-Florance, Jennifer L.; and Garcia, Ephrahim: *Overview of the DARPA/AFRL/NASA Smart Wing Phase II Program.* Proceeding of SPIE’s 2001 Symposium on Smart Structures and Materials, Newport Beach, CA, Vol. 4332, pp. 383-389, Mar. 2001.
10. Kudva, Jayanth N.; Sanders, Brian P.; Pinkerton-Florance, J.; and Garcia, Ephrahim: *DARPA/AFRL/NASA Smart Wing Program: Final Overview.* Proceedings of SPIE’s 2002 Symposium on Smart Structures and Materials, San Diego, CA, Vol. 4698, pp. 37-43, Mar. 2002.
11. Martin, Christopher A.; Bartley-Cho, Jonathan D.; Flanagan, John S.; and Carpenter, Bernie F.: *Design and Fabrication of Smart Wing Wind Tunnel Model and SMA Control Surfaces.* Proceeding of SPIE’s 1999 Symposium on Smart Structures and Materials, Newport Beach, CA, Vol. 3674, pp. 237-248, Mar. 1999.
12. Martin, Christopher A.; Scherer, Lewis B.; Flanagan, John S.; and Carpenter, Bernie: *Design, Fabrication, and Testing of Scaled Wind Tunnel Model for the Smart Wing Phase II Program.* Proceeding of SPIE’s 2001 Symposium on Smart Structures and Materials, Newport Beach, CA, Vol. 4332, pp. 399-406, Mar. 2001.
13. Mukhopadhyay, Vivek: *Transonic Flutter Suppression Control Law Design Using Classical and Optimal Techniques with Wind-Tunnel Results.* AIAA Paper 1999-1396, 40th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, St. Louis, MO, Apr. 12-15, 1999. [NACA 0012 benchmark active control wing model]
14. Mukhopadhyay, Vivek: *Transonic Flutter Suppression Control Law Design, Analysis and Wind-Tunnel Results.* CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelastic and Structural Dynamics 1999, Williamsburg, VA, June 22-25, 1999, NASA CP-1999-209136/PT1, June 1999, pp. 381-391. [NACA 0012 benchmark active control wing model]
15. Sanders, Brian P.; Martin, Christopher A.; and Cowan, David L.: *Aerodynamic and Aeroelastic Characteristics of the DARPA Smart Wing Phase II Wind Tunnel Model.* Proceedings of SPIE’s conference on Smart Structures and Materials 2001: Industrial and

Commercial Applications of Smart Structures Technology, Newport Beach, CA, Mar. 2001, Vol. 4332, pp. 390-398, June 14, 2001.

16. Scherer, Lewis B.; Martin, Christopher A.; West, Mark N.; Florance, Jennifer P.; Wieseman, Carol D.; Burner, Alpheus W.; and Fleming, Gary A.: *DARPA/ARFL/NASA Smart Wing Second Wind Tunnel Test Results.* Proceedings of SPIE's conference on Smart Structures and Materials 1999: Industrial and Commercial Applications of Smart Structures, Newport Beach, CA, Mar. 1999, Vol. 3674, pp. 249-259, July 9, 1999.
17. Matthew, John R.: *Developing, Mechanizing and Testing of a Digital Active Flutter Suppression for a Modified B-52 Wind-Tunnel Model*. NASA CR-159155, Mar 1980. [sting-mounted B-52 CCV model with multi-mode digitized active flutter suppression system, including system failure control by redundancy management]
18. McGowan, Anna-Maria R.; Heeg, Jennifer; and Lake, Renee C.: *Results of Wind-Tunnel Testing from the Piezoelastic Aeroelastic Response Tailoring Investigation.* AIAA Paper 1996-1511, 37th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, and Exhibit, Salt lake City, UT, Apr. 15-17, 1996. [PARTI]
19. McGowan, Anna-Maria Rivas; Wilkie, W. Keats; Moses, Robert W.; Lake, Renee C.; Florance, Jennifer Pinkerton; Wieseman, Carol D. ; Reaves, Mercedes C.; Taleghani, Barmac K.; Mirick, Paul H.; and Wilbur, Matthew L.: *Aeroservoelastic and Structural Dynamics Research on Smart Structures Conducted at NASA Langley Research Center*. SPIE's 1998 Structures and Materials Symposium, San Diego, CA, Mar. 1-5, 1998.
20. McWhirter, H. D.; Hollenbeck, W. W.; and Grosser, W. F.: *Correlation of C-5A Active Lift Distribution Control System (ALDCS)—Aeroelastic Model and Airplane Flight Test Results*. NASA CR-144903, Feb. 1976. [full-span, cable-mounted model]
21. Moses, Robert W.: *Active Vertical Tail Buffeting Alleviation on a Twin-Tail Fighter Configuration in a Wind Tunnel*. Proceedings of the CEAS International Forum on Aeroelasticity and Structural Dynamics, Rome, Italy, June 1997. [1/6-size F-18 model]
22. Moses, Robert W.: *Vertical Tail Buffeting Alleviation Using Piezoelectric Actuators–Some Results of the Actively Controlled Response of Buffet-Affected Tails (ACROBAT) Program*. Proceeding of SPIE's conference on Smart Structures and Materials 1997: Industrial and Commercial Application of Smart Structures Technologies, San Diego, CA, Mar. 4-5, 1997, Vol. 3400, May 23, 1997. (Also available as NASA TM-110336, Apr. 1997.) [twin tail buffet response alleviation]
23. Moses, Robert W.: *Active Vertical Tail Buffeting Alleviation on an F/A-18 Model in a Wind Tunnel*. The Second Joint NASA/FAA/DoD Conference on Aging Aircraft, Williamsburg, VA, Aug. 31-Sep. 3, 1998, NASA/CP-1999-208982/PT2, Jan. 1999, pp. 821-830. [twin tail buffet response alleviation]
24. Moses, Robert W.; and Shah, Gautam H.: *Correlation of Flight Buffet Pressures on an F/A-18 with Scaled Wind-Tunnel Measurements.* CEAS/AIAA/ICASE/NASA Langley International Forum on Aeroelastic and Structural Dynamics 1999, Williamsburg, VA, June 22-25, 1999, NASA CP-1999-209136/PT2, June 1999, pp. 615-625.
25. Perry, Boyd; Silva, Walter; Florance, James R.; Pototzky, Anthony S.; Sanetrik, Mark D.; Scott, Robert C.; Keller, Donald F.; and Cole, Stanley: *Plans and Status of Wind-Tunnel Testing Employing an Aeroservoelastic Semispan Model.* AIAA Paper 2007-1770, 48th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Confer-

ence, Honolulu, HI, Apr. 23-26, 2007. [wind-tunnel tests completed as part of the Fundamental Aeronautics Program (FAP)]

26. Pinkerton, Jennifer L.; McGowan, Anna-Maria R.; Moses, Robert W.; Scott, Robert C.; and Heeg, Jennifer: *Controlled Aeroelastic Response and Airfoil Shaping Using Adaptive Materials and Integrated Systems*. SPIE's 1996 Symposium on Smart Structures and Integrated Systems, Structures and Materials, San Diego, CA, Feb. 26-29, 1996. [PARTI, ANCAR, and ACROBAT]
27. Rainey, A. Gerald, Ruhlin, Charles L.; and Sandford, Maynard C.: *Active Control of Aeroelastic Response. Stability and Control*. AGARD Flight Mechanics Symposium on Stability and Control, Braunschweig, Germany, April 10-13, 1972, AGARD CP-119, pp. 16-1 - 16-5, 1972. [clipped-delta-wing flutter suppression model, aerodynamic energy concept]
28. Redd, L. T.; Gilman, J., Jr.; Cooley, D. E.; and Sevart, F. D.: *Wind Tunnel Investigation of a B-52 Model Flutter Suppression System*. Journal of Aircraft, Vol. 11, No. 11, Nov. 1974. (Originally AIAA Paper 1974-0401, 15th AIAA/ASME/SAE Structures, Structural Dynamics, and Materials Conference, Las Vegas, NV, Apr. 17-19, 1974.) [B-52 CCV model]
29. Sandford, Maynard C.; Abel, Irving; and Gray, David L.: *A Transonic Study of Active Flutter Suppression Based on an Aerodynamic Energy Concept.* AIAA Paper 1974-403, 15th AIAA/ASME/SAE Structures, Structural Dynamics, and Materials Conference, Las Vegas, NV, Apr. 17-19, 1974. [clipped-delta-wing flutter suppression model, aerodynamic energy concept]
30. Sandford, Maynard C.; Abel, Irving; and Gray, David L.: *Development and Demonstration of a Flutter-Suppression System Using Active Control.* NASA TR-R-450, Dec. 1975. [clipped-delta-wing flutter suppression model, aerodynamic energy concept]
31. Sevart, F. D.; Patel, S. M.; and Wattman, W. J.: *Analysis and Testing of Stability Augmentation Systems.* NASA CR-132349, June, 1972. [delta-wing flutter suppression model, B-52 CCV model]
32. Scott, Robert C.: *Active Control of Wind-Tunnel Model Aeroelastic Response Using Neural Networks.* Proceeding of SPIE conference on Smart Structures and Materials 2000: Industrial and Commercial Applications of Smart Structures Technologies, Newport Beach, CA, Mar. 6-9, 2000, Vol. 3991, June 12, 2000. [application of artificial intelligence]
33. Scott, Robert C.; Vetter, Travis K.; Penning, Kevin B.; Coulson, David A.; and Heeg, Jennifer: *Aeroservoelastic Testing of a Sidewall Mounted Free Flying Wind-Tunnel Model.* AIAA Paper 2008-7186, 48th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Honolulu, HI, Apr. 23-26, 2007. [SensorCraft wing, gust load alleviation and body freedom flutter suppression]
34. Scott, Robert C.; Castelluccio, Mark A.; Coulson, David A.; and Heeg, Jennifer: *Aeroservoelastic Wind-Tunnel Tests of a Free-Flying Joined-Wing SensorCraft Model for Gust load Alleviation.* AIAA Paper 2011-1960, 52nd AIAA/ASME/ASCE/AHS/ ASC Structures, Structural Dynamics, and Materials Conference, Denver, CO, Apr. 4-7, 2011. [model on balance and on two degree-of-freedom flexible mount, aerodynamic data, and active flutter suppression and gust load alleviation]

35. Scott. M. J.; Enke, A.; and Flanagan, J.: *SensorCraft Free-Flying Aeroservoelastic Model: Design and Fabrication.* AIAA Paper 2011-1957, 52nd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Denver, CO, Apr. 4-7, 2011.
36. Scott, Robert C.; Vetter, Travis K.; Penning, Kevin B.; Coulson, David A.; and Heeg, Jennifer: *Aeroservoelastic Testing of Free Flying Wind Tunnel Model—Part 1: A Sidewall Supported Model Tested for Gust Load Alleviation and Flutter Suppression.* NASA TP-2013-218051, Oct. 2013. [semi-span SensorCraft joined wing model mounted on balance and on two degree-of-freedom flexible support system; aerodynamic data, and active control results]
37. Scott, Robert C.; Vetter, Travis K.; Penning, Kevin B.; Coulson, David A.; and Heeg, Jennifer: *Aeroservoelastic Testing of Free Flying Wind Tunnel Model—Part 2: A Centerline Supported Fullspan Model Tested for Gust Load Alleviation.* NASA TP-2014-218170, Feb. 2014. [full-span SensorCraft joined wing model, sting-mounted on balance and flexibly mounted on rod-monkey support system; aerodynamic data and active control results]
38. Scott, Robert C.; Allen, Timothy J.; Funk, Christie J.; Castelluccio, Mark A.; Sexton, Bradley W.; Claggett, Scott; Dykman, John; Coulson, David A.; and Bartels, Robert E.: *Aeroelastic Wind-Tunnel Test of the SUGAR Truss Braced Wing Wind-Tunnel Model.* 53rd Aerospace Science Meeting (SciTech 2015), Kissimmee, FL, Jan. 5-9, 2015. [Subsonic Ultra Green Aircraft Research (SUGAR) program, active flutter suppression and gust load alleviation]
39. Seidel, David A.; Adams, William M., Jr.; Eckstrom, Clinton V.; Sandford, Maynard C.: *Investigation and Suppression of High Dynamic Response Encountered on an Elastic Supercritical Wing*. Transonic Unsteady Aerodynamics and Aeroelasticity 1987, Proceedings of a Symposium Sponsored by the NASA, Langley Research Center, Hampton, VA, May 20-22, 1987, CP-3022-PT-2, 1989, pp. 427-448. [SIO for DAST ARW-2 wing]

3.4.2.2 Active Flexible Wing (AFW) and Active Aeroelastic Wing (AAW)

1. Adams, W. M., Jr.; Christhilf, D. M.; Waszak, Martin R.; Mukhopadhyay, Vivek; and Srinathkumar, S.: *Design Test, and Evaluation of Three Active Flutter Suppression Controllers.* NASA TM-4338, Oct. 1992. [AFW]
2. Adams, W. M., Jr.; and Christhilf, D. M.: *Design and Multifunction Tests of a Frequency Domain-Based Active Flutter Suppression System.* Journal of Aircraft, Vol. 32, No. 1, Jan.-Feb. 1995, pp. 52-60. (Originally AIAA Paper 1992-2096, *Multifunction Tests of a Frequency Domain-Based Active Flutter Suppression System.* Dynamics Specialists Conference, Dallas, TX, Apr. 16-17, 1992.) [AFW]
3. Buttrill, C.; Bacon, B.; Heeg, J.; Houck, J.; and Wood, D.: *Simulation and Model Reduction for the Active Flexible Wing Program.* Journal of Aircraft, Vol. 32, No. 1, Jan.-Feb. 1995, pp. 23-31. (Originally AIAA Paper 1992-2081, AIAA Dynamics Specialists Conference, Dallas, TX, Apr. 16-17, 1992.) [AFW]
4. Florance, James R.; Heeg, Jennifer; Spain, Charles V.; Ivanco, Thomas G.; and Wieseman, Carol D.: *Variable Stiffness Spar Wind-Tunnel Model Development and Testing.* AIAA Paper 2004-1588, 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Palm Springs, CA, Apr. 19-22, 2004. [AAW]

5. Heeg, Jennifer; Spain, Charles V.; Florance, James R.; Wieseman, Carol D. ; Ivanco, Thomas G.; DeMoss, Joshua; Silva, Walter A.; Panetta, Andrew; Lively, Peter; and Tumwa, Vic. *Experimental Results from the Active Aeroelastic Wing Wind Tunnel Test Program.* AIAA Paper 2005-2234, 46th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Austin TX, Apr. 18-21, 2005. [AAW]
6. Hoadley, S. T.; and McGraw, S. M.: *Multiple Function Digital Controller System for Active Flexible Wing Wind-Tunnel Model.* Journal of Aircraft, Vol. 32, No. 1, Jan.-Feb. 1995, pp. 32-38. (Originally AIAA Paper 1992-2083, *The Multiple-Function Multi-Input/Multi-Output Digital Controller System for the AFW Wind Tunnel Model*, AIAA Dynamic Specialists Conference, Dallas, TX, Apr. 16-17, 1992; and NASA TM-107600, July 1992.) [AFW]
7. Klepl, M. J.: *Digital Flutter Suppression of Active Flexible Wing Using Moment Feedback.* Journal of Aircraft, Engineering Note, Vol. 32, No. 1, Jan.-Feb. 1995, p. 206. (Full-length paper available as AIAA Paper 1992-2098, *A Flutter Suppression System Using Strain Garages Applied to Active Flexible Wing Technology—Design and Test*, AIAA Dynamic Specialists Conference, Dallas, TX, Apr. 16-17, 1992.) [AFW]
8. Lin, C. Y.; Crawley, E. F.; and Heeg, J.: *Open-Loop and Preliminary Closed-Loop Results of a Strain Actuated Active Aeroelastic Wing.* AIAA Paper 1995-1386, AIAA 36th Structures, Structural Dynamics, and Materials Conference, New Orleans, LA, Apr. 1995. [AAW]
9. Moore, D.: *Maneuver Load Control Using Optimization Feedforward Commands*. Journal of Aircraft, Engineering Note, Vol. 32, No. 1, p. 206, Jan.-Feb. 1995. (Full-length version available as AIAA Paper 1992-2100, *Maneuver Load Control Using Optimization Feedforward Commands*, AIAA Dynamic Specialist Conference, Dallas, TX, Apr. 16-17, 1992.) [AFW]
10. Mukhopadhyay, V.: *Flutter Suppression Control Law Design and Testing for the Active Flexible Wing*. Journal of Aircraft, Vol. 32, No. 1, Jan.-Feb. 1995, pp. 45-51. (Originally AIAA Paper 1992-2095, *Flutter Suppression Digital Control Law Design and Testing for the AFW Wind Tunnel,* Model, AIAA Dynamic Specialists Conference, Dallas, TX, Apr. 16-17, 1992, and NASA TM-107652, July 1992.) [AFW]
11. Noll, Thomas; Perry, Boyd, III; Tiffany, Sherwood; Cole, Stanley R.; Buttrill, Carey; Adams, William, Jr.; Houck, Jacob; Srinathkumar, S.; Mukhopadhyay, Vivek; Pototzky, Anthony; Heeg, Jennifer; McGraw, Sandy; Miller, Gerald; Ryan, Rosemary; Brosnan, Michael; Haverty, James; and Klepl, Martin: *Aeroservoelastic Wind-Tunnel Investigation Using the Active Flexible Wing Model—Status and Recent Accomplishments*. AIAA Paper 1989-1168, 30th AIAA Structures, Structural Dynamic and Materials Conference, Mobile, AL, Apr. 3-5, 1989. (Also available as NASA TM-101570, Apr. 1989.) [AFW]
12. Noll, Thomas; and Perry, Boyd, III: *The Active Flexible Wing Aeroservoelastic Wind-Tunnel Test Program.* Workshop on Computational Aspects in the Control of Flexible Systems, Williamsburg, VA, July 12-14, 1988, NASA TM-101578 Part 2, pp. 903-941. [overview of AFW program]
13. Perry, B., III; Cole, S. R.; and Miller, G. D.: *A Summary of an Active Flexible Wing Program*. Journal of Aircraft, Vol. 32, No. 1, Jan.-Feb. 1995, pp. 10-15. (Originally AIAA Paper 1992-2080, AIAA Dynamic Specialists Conference, Dallas, TX, Apr. 16-17, 1992; and NASA TM-107655, July 1992.) [AFW]

14. Perry, B., III; Dunn, H. J.; and Sandford, M. C.: *Control Law Parameterization for an Aeroelastic Wind-Tunnel Model Equipped with an Active Roll Control System and Comparison with Experiment*. AIAA Paper 1988-2211, 29th AIAA/ASME/ASCE/ AHS/ASC Structures, Structural Dynamics, and Materials Conference, Williamsburg, VA, Apr. 18-20, 1988. (Also available as NASA TM-100593, May 1988.) [AFW]
15. Perry, Boyd, III; Mukhopadhyay, Vivek; Hoadley, Sherwood T.; Cole, Stanley R.; Buttrill, Carey S.; and Houck, Jacob A.: *Digital-Flutter-Suppression-System Investigations for the Active Flexible Wing Wind-Tunnel Model.* AIAA Paper 1990-1074, AIAA 31st AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Long Beach CA, Apr. 2-4, 1990. (Also available as NASA TM-102618, Mar. 1990.) [AFW]
16. Perry, Boyd, III; Mukhopadhyay, Vivek; Hoadley, Sherwood Tiffany.; Cole, Stanley R.; Buttrill, Carey S.; and Houck, Jacob A.: *Design, Implementation, Simulation, and Testing of Digital Flutter Suppression Systems for the Active Flexible Wing Wind-Tunnel Model.* ICAS Paper 90-1.3.2, Proceeding of the 17th Congress of the International Council of the Aeronautical Sciences, Stockholm, Sweden, Sep. 9-14, 1990, Vol. 1., pp. 408-418. [AFW]
17. Silva, W. A.; and Bennett, R. M.: *Predicting the Aeroelastic Behavior of a Wind-Tunnel Model Using Transonic Small Disturbance Theory.* ICAS Paper 90-1.1.1, Proceeding of the 17th Congress of the International Council of the Aeronautical Sciences, Stockholm, Sweden, Sep. 9-14, 1990, Vol. 1., pp. 1-10. [AFW]
18. Silva, W. A.; and Bennett, R. M.: *Investigation of the Aeroelastic Stability of the AFW Wind-Tunnel Model Using CAP-TSD.* AGARD Structures and Materials Panel Specialist's Meeting on Transonic Unsteady Aerodynamics and Aeroelasticity, San Diego, CA, Oct. 6-11, 1991. (Also available as NASA TM-104142, Sep. 1991.) [AFW]
19. Silva, W. A.; and Bennett, R. M.: *Further Investigations of the Aeroelastic Behavior of the AFW Wind-Tunnel Model using Transonic Small Disturbance Theory.* AIAA Paper 1992-2082, AIAA Dynamic Specialists Conference, Dallas, TX, Apr. 16-17, 1992. [AFW]
20. Silva, W. A.; and Bennett, R. M.: *Application of Transonic Small Disturbance Theory to the Active Flexible Wing Model.* Journal of Aircraft, Vol. 32, No. 1, Jan.-Feb. 1995, pp. 16-22. [AFW]
21. Waszak, M. R.; and Srinathkumar, S.: *Flutter Suppression for the Active Flexible Wing: A Classical Design*. Journal of Aircraft, Vol. 32, No. 1, Jan.-Feb. 1995, pp. 61-69. (Originally AIAA Paper 1992-2097, *Flutter Suppression for the Active Flexible Wing—Control System Design and Experimental Validation*, AIAA Dynamics Specialists Meeting, Dallas, TX, Apr. 16-17, 1992.) [AFW]
22. Wieseman, C. D.; Hoadley, S. T.; and McGraw, S. M.: *On-Line Analysis Capabilities Developed to Support the Active Flexible Wing Wind-Tunnel Tests.* Journal of Aircraft, Vol. 32, No. 1, Jan.-Feb. 1995, pp. 39-44. (Originally AIAA Paper 1992-2084, Dynamics Specialists Meeting, Dallas, TX, Apr. 16-17, 1992; and NASA TM-107651, July 1992.) [AFW]
23. Woods-Vedeler, J. A.; Pototzky. A. S.; and Hoadley, S. T.: *Rolling Maneuver Load Alleviation Using Active Controls.* Journal of Aircraft, Vol. 32, No. 1, Jan.-Feb. 1995, pp.

69-76. (Originally AIAA Paper 1992-2099, AIAA Dynamics Specialists Conference, Dallas, TX, Apr. 16-17, 1992; and NASA TM-107654, July 1992.) [AFW]

24. Woods-Vedeler, Jessica A.; Pototzky. Anthony S.; and Hoadley, Sherwood T.: *Active Load Control during Rolling Maneuvers.* NASA TP-3455, Oct. 1994. [AFW]

3.4.2.3 Benchmark Active Control Technology (BACT)

1. Bartels, Robert E.; and Schuster, David M.: *Comparison of Two Navier-Stokes Methods with Benchmark Active Control Technology Experiments.* Journal of Guidance, Control, and Dynamics, Vol. 23, No. 6. Nov.-Dec. 2000, pp. 1094-1099. [steady and unsteady flow, static and oscillating aileron]
2. Bennett, Robert M.; Scott, Robert C.; and Wieseman, Carol D.: *Computational Test Cases for the Benchmark Active Controls Model.* Journal of Guidance, Control, and Dynamics, Vol. 23, No. 5. Sep.-Oct. 2000, pp. 922-929. [unsteady aerodynamic and aeroelastic computational test cases]
3. Haley, Pam; and Soloway, Don: *Generalized Predictive Control for Active Flutter Suppression.* Journal of Guidance, Control, and Dynamics, Vol. 24, No. 1. Jan.-Feb. 2001, p. 154-159. [comparisons of theory with experiment for BACT model]
4. Kelkar, A. G.; and Joshi, S. M.: *Passivity-Based Robust Control with Application to Benchmark Active Control Technology Wing.* Journal of Guidance, Control, and Dynamics, Vol. 23, No. 5. Sep.-Oct. 2000, pp. 938-947. [calculations for BCAT model, but no experimental results]
5. Mukhopadhyay, Vivek: *Transonic Flutter Suppression Control Law Design and Wind-Tunnel Test Results.* Journal of Guidance, Control, and Dynamics, Vol. 23, No. 5. Sep.-Oct. 2000, pp. 930-937. [comparisons of theory with experiment for BACT model]
6. Scott, Robert C.; Hoadley, Sherwood T.; Wieseman, Carol D.; and Durham, Michael H.: *Benchmark Active Control Technology Model Aerodynamic Data.* Journal of Guidance, Control, and Dynamics, Vol. 23, No. 5. Sep.-Oct. 2000, pp. 914-921. [flutter boundaries, pressure distributions and loads, control surface effectiveness for BACT model]
7. Scott, Robert C.; and Pado, Lawrence E.: *Active Control of Wind-Tunnel Model Aeroelastic Response using Neural Networks.* Journal of Guidance, Control, and Dynamics, Vol. 23, No. 6. Nov.-Dec. 2000, pp. 1100-1108. [comparisons of theory with experiment for BACT model]
8. Waszak, Martin R.; and Fung, Jimmy: *Parameter Estimation of Actuators for Benchmark Active Control Technology (BACT) Wind Tunnel Model with Analysis of Wear and Aerodynamic Loading Effects.* NASA TM-1998-208452, July 1998. (A portion of this information was included in; *Parametric Estimation and Analysis of Actuators for BACT Wind-Tunnel Model,* AIAA Paper 1998-3362, AIAA 21st Atmospheric Flight Mechanics Conference, San Diego, CA, July 29-31, 1996.)
9. Waszak, Martin R.: *Robust Multivariable Flutter Suppression for the Benchmark Active Control Technology (BACT) Wind-Tunnel Model.* 11th Symposium on Structural Dynamics and Control, Blacksburg, VA, May 12-14, 1997. [experimental evaluation of control laws]
10. Waszak, Martin R.: *Robust Multivariable Flutter Suppression for Benchmark Active Control Technology Wind-Tunnel Model.* Journal of Guidance, Control, and Dynamics, Vol.

24, No. 1, Jan.-Feb. 2001, pp. 147-133. [comparisons of theory with experiment for BACT model]

3.4.2.4 F-16 Flutter Suppression

1. Peloubet, R. P., Jr.; Haller, R. L.; and Bolding, R. M.: *F-16 Flutter Suppression System Investigation Feasibility Study and Wind-Tunnel Tests.* Journal of Aircraft, Vol. 19, No. 2, Feb. 1982, pp. 169-175. (Originally AIAA Paper 1980-0768, *F-16 Flutter Suppression System Investigation,* 21st AIAA/ASME/ASCE/AHS Structures, Structural Dynamics, and Materials Conference, Seattle, WA, May 12-14, 1980.) [full-span, cable-mounted model]
2. Peloubet, R. P., Jr.; and Haller, R. L.: *Recent Developments in the F-16 Flutter Suppression with Active Control Program.* Journal of Aircraft, Vol. 21, No. 9, Sep. 1984, pp. 716-721. (Originally AIAA Paper 1983-0995, 24th AIAA/ASME/ ASCE/AHS Structures, Structural Dynamics, and Materials Conference, Lake Tahoe, CA, May 2-4, 1983.) [full-span, cable-mounted model]
3. Peloubet, R. P., Jr.; and Haller, Richard L.: *Wind-Tunnel Demonstration of Active Flutter Suppression Using F-16 Model with Stores.* AFWAL-TR-83-3046, Apr. 1983. [full-span, cable mounted model]
4. Peloubet, R.; Bolding, R.; and Penning, K.: *Adaptive Flutter Suppression Wind-Tunnel Test Demonstration*. AFWAL-TR-87-3053, Oct. 1987. [full-span, cable-mounted model]

3.4.2.5 YF-17 Flutter Suppression

1. Destuynder, R.: *Essais en Soufflerie sur Une Maquette de L'Avion YF 17 Concernant le Flottement D'Une Cobinaison Aile-Engin (Cooperation Internationale). Report on a Cooperative Programme on Active Flutter Suppression.* AGARD Report No. 689, Paper No. 3, Apr. 1980. [French contribution to international cooperative program, semi-span model]
2. Hönlinger, H.; Sensburg, O.; Kühn, M.; and Gödel, H.: *Active Control of an Explosive Wing-Store Flutter Case. Report on a Cooperative Programme on Active Flutter Suppression*. AGARD Report No. 689, Paper No. 2, Apr.1980. [German contribution to international cooperative program, semi-span model]
3. Hwang, C.; Winther, B.; Noll, T.; and Farmer, M.: *Demonstration of Aircraft Wing/Store Flutter Suppression Systems.* Considerations of Wing Stores Flutter, AGARD Report No. 668, Apr. 1979, pp.21-37. [United States studies, semi-span model]
4. Hwang, C.; Winther, B.; and Mills, G.: *Demonstration of Aircraft Wing/Store Flutter Suppression Systems*. AFFDL-TR-78-65, June 1978. [United States studies, semi-span model]
5. Hwang, C.; Winther, B. A.; Mills, G. R.; Noll, T. E.; and Farmer, M. G.: Demonstration of Aircraft Wing/Store Flutter Suppression Systems, Journal of Aircraft, Vol. 16, No. 8, Aug. 1997, pp. 557-563 [United States studies, semi-span model]
6. Hwang, C.; Johnson, E.; Mills, G.; Noll, T.; and Farmer, M.: *Wind-Tunnel Test of a Fighter Aircraft Wing/Store Flutter Suppression System, an International Effort.* AGARD Report on a Cooperative Programme on Active Flutter Suppression, AGARD Report No. 689, Paper No. 1, Apr. 1980. [United States contribution to international cooperative program, semi-span model]

7. Hwang, C.; Johnson, E.; Mills, G.; and Pi, W.: *Additional Demonstration of Active Wing/Store Flutter Suppression Systems.* AFWAL-TR-80-3093m 1980. [United States contribution to international cooperative program, semi-span model]
8. Hwang, C.; and Johnson, E.: *Test Demonstration of Digital Adaptive Control of Wing/Store Flutter, Part I–Demonstration of Digital Control*. AFWAL-TR-82-3044, Dec. 1982. [United States studies, semi-span model]
9. Hwang, C.; and Johnson, E. H.: *Test Demonstration of Digital Adaptive Control of Wing/Store Flutter, Part II—Demonstration of Adaptive Control*. AFWAL-TR-82-3044, Dec. 1982. [United States studies, semi-span model]
10. Johnson, E. H.; Hwang, C.; Joshi, D. S.; Harvey, C. A.; Huttsell, L. T., Farmer, M. G.: *Adaptive Flutter Suppression Analysis and Test.* AGARD Recent Transonic Flutter Investigation for Wings and External Stores, AGARD Report 703, Apr. 21-25, 1983. [United States studies, semi-span model]
11. Noll, T. E.; Huttsell, L. T.; and Cooley, D. E.: *Wing-Store Flutter Suppression Investigation.* Journal of Aircraft, Vols. 18, No. 11, Nov. 1981. (Originally *Investigation of International Control Law for Wing/Store/Flutter Suppression*, AIAA Paper 1980-0764, 21st AIAA/ASME/ASCE/AHS Structures, Structural Dynamics, and Materials Conference, Seattle, WA, May 12-14, 1980.) [United States studies, semi-span model]
12. Turner, M. R.: *Wind Tunnel Tests on a Fighter Aircraft Wing/Store Flutter Suppression system—The BAE Control Law. Report on a Cooperative Programme on Active Flutter Suppression*. AGARD Report No. 689, Paper No. 4, Apr. 1980. [United Kingdom contribution to international cooperative program, semi-span model]

3.4.2.6 SemiSpan SuperSonic Transport (S^4T) Model

1. Christhilf, David M.; Pototzky, Anthony S.; and Stevens, William L.: *Incorporation of SemiSpan SuperSonic Transport (S^4T) Aeroservoelastic Model in SAREC-ASV Simulation.* AIAA Paper 2010-8099, AIAA Atmospheric Fight Mechanics Conference, Toronto, Canada, Aug. 2-5, 2010.
2. Christhilf, David M.; Moulin, Boris; Ritz, Erich; Chen, P. C.; Roughen, Kevin M.; and Perry, Boyd, III: *Characteristics of Control Laws Tested on the Semi-Span Super-Sonic Transport (S^4T) Wind-Tunnel Model.* AIAA Paper 2012-1555, 53rd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Honolulu, HI, Apr. 23-26, 2012.
3. Christhilf, David M.: *Visualizing Flutter Mechanism as Traveling Wave Through Animation of Simulation Results for the Semi-Span Super-Sonic Transport Wind Tunnel Model.* AIAA Paper 2014-1197, 55th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, National Harbor, MD, Jan. 13-17, 2014.
4. Florance, James R.; Scott, Robert C. ; Keller, Donald F. ; Sanetrik, Mark D. ; and Silva, Walter A.: *Lessons in the Design and Characterization Testing of the Semi-Span Super-Sonic Transport (S^4T) Wind-Tunnel Model.* AIAA Paper 2012-1553, 53rd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Honolulu, HI, Apr. 23-26, 2012.
5. Heeg, Jennifer; and Wieseman, Carol D.: *System identification & uncertainty quantification using orthogonal excitations & the Semi-span SuperSonic Transport (S^4T) model.*

AIAA Paper 2012-1404, 53rd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Honolulu, HI, Apr. 23-26, 2012.

6. Hur, Jiyoung: *Aeroelastic Analyses of the SemiSpan SuperSonic Transport (S^4T) Wind Tunnel Model at Mach 0.95.* NACA CR-2014-218287, July 2014.
7. Moulin, Boris; Ritz, Erich; Chen, P. C.; Lee, D. H.; and Zhang, Z.: *CFD-based Control for Flutter Suppression, Gust Load Alleviation, and Ride Quality Enhancement for the S^4T Model.* AIAA Paper 2010-2623, 51st AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Orlando, FL, Apr. 12-15, 2010.
8. Moulin, Boris; Ritz, Erich; Florance, James; Sanetrik, Mark; and Silva, Walter: *Classic and Robust Aeroservoelastic Control for the S4T Wind-Tunnel Model.* AIAA Paper 2010-7802, AIAA Atmospheric Fight Mechanics Conference, Toronto, Canada, Aug. 2-5, 2010.
9. Sanetrik, Mark D.; Silva, Walter A.; and Hur, Jiyoung: *Computational Aeroelastic Analysis of the Semi-Span Super-Sonic (S^4T) Wind-Tunnel Model.* AIAA Paper 2012-1556, 53rd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Honolulu, HI, Apr. 23-26, 2012. [summarizes computational aeroelastic analysis for the S4T model]
10. Roughen, Kevin M.; and Bendiksen, Oddvar O.: *Active Flutter Suppression of the Supersonic Semispan Transport (S^4T) Model.* AIAA Paper 2010-2621, 51st AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Orlando, FL, Apr. 12-15, 2010.
11. Roughen, Kevin M.; and Bendiksen, Oddvar O.; and Gadient, Ross: *Active Aeroelastic Control of the Supersonic Semispan Transport (S^4T) Model.* Suppression of the Supersonic Semispan Transport (S4T) Model. AIAA Paper 2010-8397, 51st AIAA Guidance, Navigation, and Control Conference, Toronto, Canada, Aug. 2-5, 2010
12. Silva, Walter A.; Perry, Boyd, III; Florance, James R.; Sanetrik, Mark D.; Wieseman, Carol D.; Stevens, William L.; Funk, Christie J.; Hur, Jiyoung; Christhilf, David M.; and Coulson, David A.: *An Overview of the Semi-Span Super-Sonic Transport (S^4T) Wind-Tunnel Model Program.* AIAA Paper 2012-1552, 53rd AIAA/ASME/ASCE/ AHS/ASC Structures, Structural Dynamics, and Materials Conference, Honolulu, HI, Apr. 23-26, 2012. [summarizes computational and experimental aeroelastic and aeroservoelastic results]
13. Wieseman, Carol; Christhilf, David; and Perry, Boyd, III: *Analytical and Experimental Evaluation of Digital Control Systems for the Semi-Span Super-Sonic Transport (S^4T) Wind Tunnel Model.* AIAA Paper 2012-1554, 53rd AIAA/ASME/ ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Honolulu, HI, Apr. 23-26, 2012.
14. Zeng, Jie; Moulin, Boris; and Kukreja, Sunil. *Experiential Model Based Robust Aeroservoelastic Control for the S^4T Wind Tunnel Model.* AIAA Paper 2011-6370, AIAA Atmospheric Flight Mechanics Conference, Portland, OR, Aug. 8-11, 2011.

3.4.3 Passive Control

1. Desmarais, Robert N.; and Reed, Wilmer H., III: *Wing/Store Flutter with Nonlinear Pylon Stiffness.* Journal of Aircraft, Vol. 18, No. 11, Nov. 1981, pp. 984-987. (Originally AIAA Paper 1980-0792, 21st AIAA/ASME/ASCE/AHS Structures, Structural Dynamics,

and Materials Conference, Seattle, WA, May 12-14, 1980; and NASA TM 81789, Apr. 1980) [decoupler pylon related]

2. Murphy, A. C.; Rogers, W. A.; Shirk, M. H.; and Ruhlin, C. L.: *Design, Testing and Analysis of Aeroelastically Tailored Transonic Flutter Model Wings*. AIAA Paper 1983-1027, 24th AIAA/ASME,/ASCE/AHS Structures, Structural Dynamics, and Materials Conference, Lake Tahoe, CA, May 2-4, 1983. [semispan wash-in and wash-out wings]
3. Reed, W. H., III; Foughner, J. T., Jr.; and Runyan, H. L., Jr.: *Decoupler Pylon: A Simple, Effective Wing/Store Flutter Suppressor*. Journal of Aircraft, Vol. 17, No. 3, Mar. 1980, pp. 206-211. (Originally AIAA Paper 1979-0791, 20th AIAA/ASME/ ASCE/AHS Structures, Structural Dynamics, and Materials Conference, St. Louis, MO, Apr. 4-6, 1979.) [effectiveness demonstrated by analysis and wind-tunnel tests]
4. Reed, Wilmer H., III; Cazier, Frank W., Jr.; and Foughner, Jerome T., Jr.: *Passive Control of Wing/Store Flutter*. Fifth JTCG/MD Aircraft Stores Compatibility Symposium, St. Louis, Mo. Sept 9-11, 1980. (Also available as NASA TM-81865, Dec. 1980.) [decoupler pylon mounted on F-16 and YF-17 aeroelastic models.]
5. Reed, Wilmer H, III: *Decoupler Pylon Wing/Store Flutter Suppressor*. United States Patent 4,343,447, 10 Aug. 1982.
6. Stewart, Eric C.; and Redd, L. Tracey.: *A Comparison of the Results of Dynamic Wind-Tunnel Tests with Theoretical Predictions for an Aeromechanical Gust-Alleviation System for Light Airplanes*. NASA TN D-8521, Sep. 1977. [full-span general aviation airplane model, rod/monkey mounted]
7. Stewart, Eric C.: and Doggett, Robert V., Jr.: *Dynamic Wind-Tunnel Tests of an Aeromechanical Gust-Alleviation System Using Several Different Combinations of Control Surfaces*. NASA TM-78638, Mar. 1978. [full-span general aviation airplane model, rod/monkey mounted]

3.5 Benchmark Models Program

1. Bennett, Robert M.; Dansberry, Bryan E.; Farmer, Moses G.; Eckstrom, Clinton V.; Seidel, David A.; Rivera, José A. Jr.: *Transonic-Shock-Induced Dynamics of a Flexible Wing with a Thick Circular-Arc Airfoil*. Journal of Aircraft, Vol. 30, No. 1, Jan.-Feb. 1993, pp. 112-118. (Originally AIAA Paper 1991-1107, 32nd AIAA/ASME/ASCE/ AHS/ASC Structures, Structural Dynamics, and Materials Conference, Baltimore, MD, Apr. 8-10, 1991; and NASA TM-104088, May 1991.) [SIO and buffeting of a generic flexible, semispan wing model with 18-percent thick biconvex airfoil section]
2. Bennett, Robert M.; Eckstrom, Clinton V.; Rivera, José A., Jr.; Dansberry, Bryan E.; Farmer, Moses G.; and Durham, Michael H.: *The Benchmark Aeroelastic Models Program–Description and Highlights of Initial Results.* AGARD Structures and Materials Panel Specialists' Meeting on Transonic Unsteady Aerodynamics and Aeroelasticity, Paper No 25 (AGARD CP-29507), San Diego, CA, Oct. 9-11, 1991. (Also available as NASA TM-104180, Dec. 1991.)
3. Bennett, Robert M.; Scott, Robert C.; and Wieseman, Carol D.: *Computational Test Cases for Benchmark Active Controls Model.* Journal of Guidance, Control, and Dynamics, Vol. 23, No. 5, Sep.-Oct. 2000, pp. 922-929.

4. Bennett, R. M.: *Test Cases for Flutter of the Benchmark Models Rectangular Wings on the Pitch and Plunge Apparatus.* Verification and Validation Data for Computational Unsteady Aerodynamics, RTO Technical Report 26, Oct. 2000, pp. 173-199.
5. Bennett, Robert M.; Scott, Robert C.; and Wieseman, Carol D.: *Test Cases for Benchmark Active Controls: Spoiler and Control Surface Oscillations and Flutter.* Verification and Validation Data for Computational Unsteady Aerodynamics, RTO Technical Report 26, Oct. 2000, pp. 201-224.
6. Dansberry, B. E.: *Dynamic Characteristics of a Benchmark Models Program Supercritical Wing.* NASA TM 4457, Sep. 1993. [PAPA mounted, rectangular wing with NASA SC(2)-0414 airfoil section]
7. Dansberry, Bryan E.; Durham, Michael H.; Bennett, Robert M.; Rivera, José A.; Silva, Walter A.; and Wieseman, Carol D.: *Experimental Unsteady Pressure at Flutter on the Supercritical Wing Benchmark Model*. AIAA Paper 1993-1592, 34th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, La Jolla, CA, Apr. 19-22, 1993. [PAPA mounted, rectangular wing with NASA SC(2)-0414 airfoil section]
8. Dansberry, B. E.; Durham, M. H.; Bennett, R. M.; Turnock, D. L.; Silva, W. A.; and Rivera, José A.: *Physical Properties of the Benchmark Models Program Supercritical Wing.* NASA TM 4457, Sep. 1993. [PAPA mounted, rectangular wing with NASA SC(2)-0414 airfoil section]
9. Durham, Michael H.; Keller, Donald F.; Bennett, Robert M.; and Wieseman, Carol D.: *A Status Report on a Model for Benchmark Active Controls Testing*. AIAA Paper 1991-1011, 32nd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Baltimore, MD, Apr. 8-10, 1991. (Also available as NASA TM 107582, 1991.)
10. Heeg, Jennifer; and Piatak, David J.: *Experimental Data from the Benchmark SuperCritical Wing Wind Tunnel Test on an Oscillating Turntable.* AIAA Paper 2013-1802, 54th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Boston, MA, Apr. 8-11, 2013.
11. Rivera, José A., Jr.; Dansberry, Bryan E.; Durham, Michael H.; Bennett, Robert M.; and Silva, Walter A.: *Pressure Measurements on a Rectangular Wing with a NACA 0012 Airfoil During Conventional Flutter*. NASA TM-104211, July 1992.
12. Rivera, José A.; Dansberry, Bryan E.; Farmer, Moses G.; Eckstrom, Clinton V.; Seidel, David A.; and Bennett, Robert M.: *Experimental Flutter Boundaries with Unsteady Pressure Distributions for the NACA 0012 Benchmark Model.* AIAA Paper 1991-1010, 32nd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Baltimore, MD, Apr. 1991. (Also available as NASA TM-104072, July 1991.)
13. Rivera, José A.; Dansberry, Bryan E.; Bennett, Robert M.; Durham, Michael H.; and Silva, Walter A.: *NACA 0012 Benchmark Model Experimental Flutter Results With Unsteady Pressure Distributions*. AIAA Paper 1992-2396, 33rd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Dallas TX, Apr. 13-15, 1992. (Also available as NASA TM-107581, Mar. 1992.)
14. Scott, Robert C.; Hoadley, Sherwood T.; Wieseman, Carol D.; Durham, Michael H.: *Benchmark Active Controls Technology Model Aerodynamic Data*. Journal of Guidance,

Control, and Dynamics, Vol. 23, No. 5, Sep.-Oct. 2000, pp. 914-921. (Originally AIAA Paper 1997-0829, 35th AIAA Aerospace Sciences Meeting and Exhibit, Reno, NV, Jan. 6-10, 1997.)

15. Schuster, D. M.; and Bartels, R. E.: *Benchmark Active Control Technology (BACT) Wing CFD Results.* Verification and Validation Data for Computational Unsteady Aerodynamics, RTO Technical Report 26, Oct. 2000, pp. 228-238.

16. Waszak, Martin R.: *Modeling the Benchmark Active Control Technology Wind-Tunnel Model for Active Control Design Applications.* NASA TP-1998-206270, June 1998. [formulation of improved analytical representation of wind-tunnel model]

3.6 Flutter/Divergence/Buffeting/Gust Studies

1. Batina, John T.; Bennett, Robert M.; Seidel, David A.; Cunningham, Herbert J.; and Bland, Samuel R.: *Recent Advances in Transonic Computational Aeroelasticity.* Symposium on Advances and Trends in Computational Structural Mechanics and Fluid Dynamics, Washington, D. C., Oct. 17-19, 1988. (Also available as NASA TM-100663, Sep. 1988.) [calculated flutter results compared to experimental data for 45^0-sweep wing]
2. Bennett, Robert M.; and Bland, Samuel R.: *Experimental and Analytical Investigation of Propeller Whirl Flutter of a Power Plant on a Flexible Wing.* NASA TN D-2399, Aug, 1964. [Lockheed Electra wing model]
3. Baker, Myles L.; Mendoza, Raul; and Hartwich, Peter M.; *Transonic Aeroelastic Analysis of a High Speed Transport Wind Tunnel Model.* AIAA Paper 1999-1217, 40th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, St. Louis, MO, Apr. 12-15, 1999. [compares calculated flutter results with experimental results for the flexible semi-span high-speed research model]
4. Bland, Samuel R.; and Bennett, Robert M.: *Wind-Tunnel Measurement of Propeller Whirl-Flutter Speeds and Static-Stability Derivatives and Comparison with Theory*. NASA TN D-1807, 1963. [isolated, rigid propeller system mounted on simulated power plant with pitch and yaw flexibility, part of a number of studies precipitated by Lockheed Electra investigation]
5. Cazier, F. W., Jr.; Doggett, Robert V., Jr.; and Ricketts, Rodney H.: *Structural Dynamics and Aeroelastic Considerations for Hypersonic Vehicles.* AIAA Paper 1991-1255, 32nd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Baltimore, MD, Apr. 8-10, 1991. (Also available as NASA TM-104110, June 1991.) [NASP related, flutter and divergence of all-movable delta wing]
6. Cole, Stanley R.: *Divergence Study of a High-Aspect Ratio, Forward Swept Wing*. Journal of Aircraft, Engineering Notes, Vol. 25, No. 5, May 1988, pp. 478-480. (Original full-length paper: AIAA Paper 1986-0009, 24th AIAA Aerospace Sciences Meeting, Reno, NV, Jan. 6-9, 1986. (Also available as NASA TM-87682, June, 1986.) [similar to Rotor Systems Research Aircraft (RSRA) X-wing blade]
7. Cole, Stanley: *Flutter of a Low-Aspect-Ratio Rectangular Wing.* NASA TM-4116, June 1989. [aspect ratio 1.5 research wing, paddle configuration]
8. Cole, Stanley R.; Moss, Steven W.; and Doggett, Robert V., Jr.: *Some Buffet Response Characteristics of a Twin-Vertical-Tail Configuration*. NASA TM-102749, Oct. 1990. [original rigid low-speed F-18 stability model equipped with flexible vertical tails]

9. Cole, Stanley R.: *Aeroelastic Effects of Spoiler Surfaces on a Low-Aspect-Ratio Rectangular Wing*. Journal of Aircraft, Vol. 29, No. 5, Sep.-Oct. 1992, pp. 768-773. (Originally AIAA Paper 1990-0981, *Effects of Spoiler Surfaces on the Aeroelastic Behavior of a Low-Aspect-Ratio Rectangular Wing,* 31st AIAA/ASME/ASCE/ AHS/ASC Structures, Structural Dynamics, and Materials Conference, Long Beach, CA, Apr. 2-4, 1990; and NASA TM-102622, Apr. 1990.) [paddle-type rectangular-planform research wing with vertically mounted spoilers]
10. Dansberry, Bryan E.: Rivera, José A., Jr.: and Farmer, Moses G.: *An Experimental Study of Tip Shape Effects of the Flutter of Aft-Swept, Flat-Plate Wings.* NASA TM-4180, 1990. [simple research models]
11. Doggett, Robert V., Jr.; and Farmer, Moses G.: *Preliminary Study of Effects of Winglets on Wing Flutter*. NASA TM X-3433, Dec. 1976. (updates previous paper by same authors: *A Preliminary Study of Effects of Vortex Diffusers (Winglets) on Wing Flutter*. NASA TM X-72799, Dec. 1975.) [research model with wing planform similar to L-1011 airplane]
12. Doggett, Robert V., Jr.; and Ricketts, Rodney H.: *Some Experimental and Theoretical Flutter Characteristics of an Arrow-Wing Configuration.* AIAA Paper 1977-0422, 18th AIAA/ASME Structures, Structural Dynamics, and Materials Conference, San Diego, CA, Mar. 21-23, 1977. [parametric study of the effects of some configuration variables on flutter]
13. Doggett, Robert V., Jr.; and Ricketts, Rodney H.: *Dynamic Response of a Forward-Swept Wing Model at Angles of Attack up to 15^o at a Mach Number of 0.8.* NASA TM-81863, Nov. 1980. [buffet response, X-29A wing model]
14. Doggett, Robert V., Jr.; and Ricketts, Rodney H.: *Effects of Angle of Attack and Vertical Fin on Transonic Flutter Characteristics of an Arrow-Wing Configuration.* NASA TM-81914, Dec. 1980. [research model]
15. Doggett, Robert V., Jr.: *Some Effects of Aerodynamic Spoilers on Wing Flutter*. NASA TM-101632, July 1989. (See also: *Flutter Spoilers.* NASA Tech Briefs, Vol. 15, No. 9, Sept, 1991, pp. 93-940.) [hinged spoilers (speed brakes)]
16. Doggett, Robert V., Jr.; Soistmann, David L.; Spain, Charles V.; Parker, Ellen C.; and Silva, Walter A.: *Experimental Transonic Flutter Characteristics of Two 72^o-Sweep Delta-Wing Models*. NASP TM-1079, Aug. 1989. (Also available as NASA TM-101659, Aug. 1989.) [delta wing and clipped delta wing models]
17. Doggett, Robert V., Jr.; Ricketts, Rodney H.; Noll, T. E.; and Malone, John B.: *NASP Aeroservothermoelasticity Studies.* NASA TM-104058, Apr. 1991. (Identical paper presented by Noll at Tenth National Aero-Space Plane Technology Symposium and available as NASP TM 1139, Aug. 1991.) [NASP related, flutter of 72^o-sweep delta wing model, flutter and divergence of all-moveable delta-wing model, and aileron buzz model]
18. Doggett, R. V., Jr.; and Soistmann, D. L.: *Low-Speed Flutter Characteristics of Some Simple Low-Aspect-Ratio Delta-Wing Models*. Journal of Aircraft, Vol. 29. No. 2, Mar.-Apr. 1992, pp. 173-279. (Originally AIAA Paper 1989-1325, *Some Low-Speed Flutter Characteristics of Simple Low-Aspect-Ratio Delta-Wing Models*. 30th AIAA/ASME/ AHS/ASC Structures, Structural Dynamics, and Materials Conference, Mobile, AL, Apr. 3-4, 1989; and NASA TM-101547, Jan. 1989.) [parametric studies of wing sweep on flutter]

19. Durham, Michael H.; Cole, Stanley R.; Cazier, F. W., Jr.; Keller, Donald F.; Parker, Ellen C.; Wilkie, W. Keats, and Doggett, Robert V., Jr.: *Parametric Flutter Studies of an Arrow-Wing Configuration: Some Early Results.* NASA TM-100608, May 1988. [research SST configuration, effects on flutter of parametric changes in structural and geometric characteristics]

20. Durham, Michael H.; Cole, Stanley R.; Cazier, F. W., Jr.; Keller, Donald F.; Parker, Ellen C.; and Wilkie, W. Keats: *Experimental Transonic Flutter Characteristics of Supersonic Cruise Configurations.* AIAA Paper 1990-0979, 31st AIAA/ASME/ ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Long Beach, CA, Apr. 2-4, 1990. (Also available as NASA TM-102638, June 1990.) [research models, effects on flutter or parametric changes in structural and geometric characteristics]

21. Edwards, John W.; Spain, Charles V.; Keller, Donald F.; and Moses, Robert W.: *Transport Wing Flutter Model Transonic Limit Cycle Oscillation Test.* Journal of Aircraft, Vol. 46, No. 4, July-Aug. 2009, pp. 1004-1113. (Originally AIAA Paper 2001-1291, *MAVRIC Flutter Model Transonic Limit Cycle Oscillation Test*, 19th AIAA Applied Aerodynamics Conference, Seattle, WA, Apr. 2002; and NASA TM-2001-210877.) [model representative of modern subsonic transport]

22. Farmer, Moses G.; Hanson, Perry W.; Wynne, Eleanor C.: *Comparison of Supercritical and Conventional Wing Flutter Characteristics.* AIAA Paper 1976-1560, 17th AIAA/ ASME/SAE Structures, Structural Dynamics, and Materials Conference, Valley Forge, PA, May 5-7 1976. (Also available as NASA TM X-72837, May 1976.) [smooth surface wings, subsonic transport planform (same as TF-8A Supercritical Wing (SCW) demonstrator)]

23. Grosser, W. F.; Britt, R. T.; Childs, C. B.; Crooks, O. J.; and Cazier, F. W.: *A High-Speed Wind Tunnel Study of the Flutter and Steady/Unsteady Aerodynamic Characteristics of a Supercritical Versus Conventional Airfoil Transport Wing.* AGARD 55th Structures and Materials Panel, Toronto, Canada, Sep. 20-24, 1982. (Published in AGARD-R-703, Jan. 1983.) [semispan subsonic transport wings of spar/segmented-pod construction]

24. Ivanco, Thomas G.; Heeg, Jennifer; Rivera, Jose A., Jr.: *An Investigation of Leading Edge Control Surface Divergence and Its Experimental Prediction.* AIAA Paper 2003-1960, 44th AIAA/ASME/ASCE/AHS Structures, Structural Dynamics, and Materials Conference, Norfolk, VA, Apr. 7-10, 2003. [free-to-pitch model with leading edge control, evaluation of subcritical response method for divergence prediction]

25. Keller, Donald F.; and Bullock, Ellen Parker: *Span Reduction Effects of Flutter Characteristics of Arrow-Wing Supersonic Transport Configurations*. NASA TP-3077, May 1991. [research model]

26. Keller, Donald F.; Sandford, Maynard C.; and Pinkerton, Theresa L.: *Planform Curvature Effects on Flutter Characteristics of a Wing with 56^o Leading-Edge Sweep and Panel Aspect Ratio of 1.14*. NASA TP-3116, Sep. 1991. [semispan models, 3-percent thick biconvex airfoil section, parametric changes in radius of curvature of leading edge]

27. Moses, Robert W.; and Ashley, Holt: *Spatial Characteristics of the Unsteady Differential Pressures on 16% F/A-18 Vertical Tails.* AIAA Paper 1998-0519, 36th AIAA Aerospace Sciences Meeting and Exhibit, Reno, NV, Jan. 12-15, 1998. (Also available as NASA TM-1998-207323, Jan. 1988.) [buffeting related pressures]

28. Moses, Robert W.; and Pendleton, Ed: *A Comparison of Pressure Measurements between a Full-Scale and a 1/6-Scale F/A-18 Twin Tail during Buffet.* NASA TM-110282, Aug. 1996. [buffeting related pressures]

29. Moses, Robert W.: *Fin Buffeting Features of an Early F-22 Model.* AIAA Paper 2000-1695, 41st AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Atlanta, GA, Apr. 3-6, 2000. [buffeting pressure, flow "visualization" with tufts]

30. Moss, Steven W.; Cole, Stanley R.; and Doggett, Robert V., Jr.: *Some Subsonic and Transonic Buffet Characteristics of the Twin Vertical-Tails of a Fighter Airplane Configuration*. AIAA Paper 1991-1049, 32nd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Baltimore, MD, Apr. 8-10, 1991. [rigid low-speed F-18 stability model equipped with flexible vertical tails]

31. Murphy, Arthur C.: *Experimental and Analytical Study on the Flutter and Gust Response Characteristics of a Torsion-Free-Wing Airplane Model*. NASA CR-159283 (Contract NASW-15412, General Dynamics), Mar. 1981. [research model]

32. Parker, Ellen C.; Spain, Charles V.; and Soistmann, David L.: *Experimental Transonic Buzz Characteristics of a Clipped-Delta-Wing Model with a Full-Span Aileron.* NASP Contractor Report 1083, May 1990. [highly swept delta wings with trailing edge control surface]

33. Parker, Ellen C.; Spain, Charles V.; and Soistmann, David L.: *Aileron Buzz Investigated on Several Generic NASP Wing Configurations.* AIAA Paper 1991-0936, 32nd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Baltimore, MD, Apr. 8-10, 1991. [highly swept delta wings with trailing edge control surface]

34. Pototzky, Anthony S.; Spain, Charles V.; Soistmann, David L.; and Noll, Thomas E.: *Application of Unsteady Aeroelastic Analysis Techniques on the National Aerospace Plane*. Fourth National Aerospace Plane System, Monterey, CA, Feb. 1988. (Also available as NASA TM-100648) [flutter calculations compared with previous experimental results for 72^0-sweep delta wing, and series of wings with sweep-back as a parameter]

35. Redd, L. T.; Hanson, P. W.; and Wynne, E. C.: *Dynamic Response of Airplanes to Atmospheric Turbulence Including Flight Data on Input and Response*. NASA TP-1501, Nov. 1979. [B-52 CCV model]

36. Ricketts, Rodney H.; and Doggett, Robert V., Jr. (appendix by Wilmer H. Reed, III): *Wind-Tunnel Experiments on Divergence of Forward-Swept Wings*. NASA TP-1685, Aug. 1980. [parametric divergence study that also describes development and validation of a number of subcritical response techniques for predicting divergence onset, and development of aeroelastic instability stoppers]

37. Rivera, José A., Jr.: *An Experimental and Analytical Investigation of the Effect of Spanwise Curvature on Wing Flutter at Mach Number of 0.7*. NASA TN-4094, Feb, 1989. [two series of aspect ratio 1.5 rectangular-planform research models, flat plate and NACA 65 series airfoils, parametric changes in curvature]

38. Ruhlin, Charles L.; Destuynder, Roger M.; and Gregory, Richard A.: *Some Tunnel-Wall Effects on Transonic Flutter*. Journal of Aircraft, Vol. 12, No. 3, Mar. 1975, pp. 162-167. [clipped delta-wing model]

39. Ruhlin, Charles L.; Doggett, Robert V., Jr.; and Gregory, Richard A.: *Geared Elevator Flutter Study*. AIAA Paper 1976-1559, 17th AIAA/ASME/SAE Structures, Structural Dynamics, and Materials Conference, Valley Forge, PA, May 5-7, 1976. (Also available as NASA TM X-73902, May 1976.) [empennage/aft fuselage model of National SST configuration]

40. Ruhlin, Charles L.; Doggett, Robert V., Jr.; and Gregory, Richard A.: *Experimental and Analytical Transonic Flutter Characteristics of a Geared-Elevator Configuration*. NASA TP-1666, June, 1980. [empennage/aft fuselage model of National SST configuration, updates and expands previous publications]

41. Ruhlin, C. L.; and Murphy, A. C.: *Transonic Flutter and Gust-Response Tests and Analyses of a Wind-Tunnel Model of a Torsion-Free-Wing Fighter Airplane*. AIAA Paper 1981-0650, Dynamic Specialist Conference, Atlanta, GA, Apr. 9-10, 1981. (Also available as NASA TM-81961, Apr. 1981.) [research model]

42. Ruhlin, Charles L.; and Pratt-Barlow, Charles R.: *Transonic Flutter Study of a Wind-Tunnel Model of an Arrow Wing Supersonic Transport*. AIAA Paper 1981-0645, AIAA Dynamics Specialists Conference, Atlanta, GA, Apr. 9-10, 1981. (Also available as NASA TM-81962, Apr. 1981.) [1/20-scale, low-speed flutter model of SCAT-15F configuration]

43. Sandford, Maynard C.; Ruhlin, Charles L.; and Abel, Irving: *Transonic Flutter Characteristics of a 50.5^o Clipped-Delta Wing with Two Rearward-Mounted Nacelles*. NASA TN D-7544, June 1974. [configuration similar to national SST wing, precursor to clipped-delta wing active flutter suppression studies]

44. Schuster, D. M.; Spain, C. V.; Turnock, D. L.; Rausch, R. D.; Hamouda, M-Nabil H.; Vogler, W. A.; and Stockwell, A. E.: *Development, Analysis, and Testing of the High Speed Research Flexible Semispan Model*. NACA CR-1999-209556, Sep. 1999. [flutter, and pressure and loads data, comparisons of theory with experiment]

45. Seidel, David A.; Eckstrom, Clinton V.; and Sandford, Maynard C.: *Transonic Region of High Dynamic Response Encountered on an Elastic Supercritical Wing*. Journal of Aircraft, Vol. 26, No. 9, Sep. 1989, pp. 870-875. [SIO, subsonic transport wing]

46. Seidel, D. A.; Eckstrom, C. V.; and Sandford, M. C.: *Transonic Region of High Dynamic Response Encountered on an Elastic Supercritical Wing*. Journal of Aircraft, Vol. 26, No. 9, Sep. 1988, pp. 860-875. (Originally, AIAA Paper 1987-0735, *Investigation of Transonic Region of High Dynamic Response Encountered on an Elastic Supercritical Wing*, 28th AIAA/ASME/ASCE/AHS Structures, Structural Dynamics, and Materials Conference, Monterey, CA, Apr. 6-8, 1987. (Also available as NASA TM-89121, Mar. 1987.) [subsonic transport wing, SIO study]

47. Soistmann, David L.; and Spain, Charles V.: *An Experimental and Analytical Study of a Lifting Body Wind-Tunnel Model Exhibiting Body Freedom Flutter*. AIAA Paper 1993-1316, 34th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, La Jolla, CA, Apr. 19-22, 1993. [pedestal-mounted, full-span generic NASP model]

48. Spain, Charles V.; Soistmann, David L.; Parker, Ellen C.; Gibbons, Michael D.; Gilbert, Michael G.: *An Overview of Selected NASP Aeroelastic Studies at the NASA Langley Research Center*. AIAA Paper 1990-5218, AIAA Second International Aerospace Planes

Conference, Orlando, FL, Oct. 29-31, 1990. [parametric flutter studies of delta wings, arrow wing flutter, all-movable-wing flutter, and aileron buzz]

49. Yates, E. Carson, Jr.; Land, Norman S.; and Foughner, Jerome T., Jr.: *Measured and Calculated Subsonic and Transonic Flutter Characteristics of a 45^o Sweptback Wing Planform in Air and in Freon-12 in the Langley Transonic Dynamics Tunnel.* NASA TN D-1616, Mar. 1963. [results from early research studies in TDT, Tests No. 2, 3, and 6]
50. Yates, E. C., Jr.; Wynne, E. C.; and Farmer, M. G.: *Effects of Angle of Attack on Transonic Flutter of a Supercritical Wing.* Journal of Aircraft, Vol. 20, No. 10, Oct. 1983, pp. 841-847. (Originally, AIAA Paper 1982-0647, *Measured and Calculated Effects of Angle of Attack on the Transonic Flutter of a Supercritical Wing,* 23rd AIAA/ASME/ASCE/AHS Structures, Structural Dynamics, and Materials Conference, New Orleans, LA, May 10-12, 1982. (Also available as NASA TM-83276, Mar. 1981.) [smooth surface wings, subsonic transport planform (same as TF-8A Supercritical Wing (SCW) demonstrator), expands experimental data base of AIAA Paper 1976-1560, and NASA TM X-72837, citation 22 above.]

3.7 Aerodynamics, Experiment and Theory

3.7.1 Surveys/Overviews

1. Sandford, M. C.; Ricketts, R. H.; and Hess, R. W.: *Recent Transonic Unsteady Pressure Measurements at the NASA Langley Research Center*. Second DGLR/DFVLR International Symposium on Aeroelasticity and Structural Dynamics, Paper No. 85-23, Aachen, Germany, Apr. 1-3, 1985. (Also available as NASA TM-86408, Apr. 1985.) [high aspect ratio wing with oscillating control surfaces, pitching rectangular wing, and pitching delta wing tests]
2. Schuster, David M.; Edwards, John W.; and Bennett, Robert M.: *An Overview of Unsteady Pressure Measurements in the Transonic Dynamics Tunnel.* AIAA Paper 2000-1770, AIAA Dynamics Specialists Conference, Atlanta, GA, Apr. 5-6, 2000. [illustrative examples up to year 2000]
3. Schuster, David M.; Scott, Robert C.; Bartels, Robert E.; Edwards, John W.; and Bennett, Robert M.: *A Sample of NASA Langley Unsteady Pressure Experiments for Computational Aerodynamics Code Evaluation.* AIAA Paper 2000-2602, AIAA Fluids 2000 Conference and Exhibit, Denver, CO, June 19-22, 2000. [illustrative examples of a number of comparisons of theory and experiment]

3.7.2 Unsteady Pressure and Force Measurements

1. Bennett, Robert M.; and Walker, Charlotte E.: *Computational Test Cases for a Clipped Delta Wing with Pitching and Trailing-Edge Control Surface Oscillations*. NASA TM/1999-209104, Mar. 1999. [supplement to AGARD Report 702, *Compendium of Unsteady Aerodynamic Measurements*, Structures and Materials Panel, Aug. 1982]
2. Bennett, Robert M.; and Walker, Charlotte E.: *Computational Test Cases for a Rectangular Supercritical Wing Undergoing Pitching Oscillations.* NASA/TM-1999-209130, Apr. 1999. [supplement to AGARD Report 702, *Compendium of Unsteady Aerodynamic Measurements*, Structures and Materials Panel, Aug. 1982]
3. Bennett, R. M: *Test Cases for a Rectangular Supercritical Wing Undergoing Pitching Oscillations.* Verification and Validation Data for Computational Unsteady Aerodynamics, RTO Technical Report 26, Oct. 2000, pp. 153-172.

4. Bennett, R. M.: *Test Cases for a Clipped Delta Wing with Pitching and Trailing-Edge Control Surface Oscillations.* Verification and Validation Data for Computational Unsteady Aerodynamics, RTO Technical Report 26, Oct. 2000, pp. 239-255.
5. Cazier, F. W., Jr.; Watson, Judith J.; Doggett, Robert V., Jr.; Sandford, Maynard C.; and Ricketts, Rodney H.: *Measured Transonic Unsteady Pressures on an Energy Efficient Transport Wing with Oscillating Control Surfaces*. Advanced Aerodynamics—Selected NASA Research, Fifth Annual Status Review of the NASA Aircraft Energy Efficiency (ACEE) Energy Efficient Transport Program, Dryden Flight Research Center, Edwards, CA, Sep. 14-15, 1981, NASA CP-2208, pp. 21-36, Dec. 1981. [sidewall mounted, semispan aspect ratio 10.76 wing, oscillating leading edge and trailing edge control surfaces]
6. Eckstrom, Clinton V.; Seidel, David A.; and Sandford, Maynard C.: *Unsteady Pressure and Structural Response Measurements on an Elastic Supercritical Wing*. Journal of Aircraft, Vol. 27, No. 1, Jan. 1990, pp. 75-80. (Originally AIAA Paper 1988-2277, 29th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Williamsburg, VA, Apr. 18-20, 1988.)
7. Eckstrom, Clinton V.; Seidel, David A.; and Sandford, Maynard C.: *Measurement of Unsteady Pressure and Structural Response for an Elastic Supercritical Wing.* NASA TP-3443, Nov. 1994. [DAST ARW-2 right wing]
8. Hess, R. W.; Wynne, E. C.; and Cazier, F. W., Jr.: *Static and Unsteady Pressure Measurements on a 50 Degree Clipped Delta Wing at M=0.9.* AIAA Paper 1982-0686, 23rd AIAA/ASME/ASCE/AHS Structures, Structural Dynamics, and Materials Conference, New Orleans, May 10-12, 1982. (Also available as NASA TM-81-83297, Mar. 1982.) [planform similar to National SST wing, data obtained for pitching wing, and for static and oscillatory deflections of control surfaces]
9. Hess, R. W.; Cazier, F. W., Jr.; and Wynne, E. C.: *Steady and Unsteady Transonic Pressure Measurements on a Clipped Delta Wing for Pitching and Control-Surface Oscillations.* NASA TP-2594, Oct. 1986. [planform similar to national SST wing, data obtained for pitching wing, and for static and oscillatory deflections of control surfaces]
10. Moreno, R.; Taylor, P. F.; and Newsom, J. R.: *A Rigid Horizontal Tail Wind Tunnel Test for High Transonic Mach and High Frequency Unsteady Pressure Acquisition.* AIAA Paper 2012-1465, 53rd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Honolulu, HI, Apr. 23-26, 2012.
11. Piette, D. S.; Crooks, O. J.; and Cazier, F. W.: *Experimental Transonic Steady State and Unsteady Pressure Measurements on a Supercritical Wing during Flutter and Forced Discrete Frequency Oscillation.* AIAA Paper 1985-0664, 26th AIAA/ASME/ASCE/AHS Structures, Structural Dynamics, and Materials Conference, Orlando, FL, Apr. 15-17, 1985. [semi-span subsonic transport wing, oscillated in pitch]
12. Ricketts, R. H.; Sandford, M. C.; Watson, J. J.; and Seidel, D. A.: *Geometric and Structural Properties of a Rectangular Supercritical Wing Oscillated in Pitch for Measurements of Unsteady Transonic Pressure Distributions.* NASA TM-85673, Aug. 1983. [provides information necessary to making calculations for this model]
13. Ricketts, R. H.; Sandford, M. C.; Seidel, D. A.; and Watson, J. J.: *Transonic Pressure Distributions on a Rectangular Supercritical Wing Oscillating in Pitch.* Journal of Aircraft, Vol. 21, No. 8, Aug, 1984, pp. 576-582. (Originally AIAA Paper 1983-0923, 24th AIAA/ASME/ASCE/AHS Structures, Structural Dynamics, and Materials Conference,

Lake Tahoe, CA, May 2-4, 1983; and NASA TM-84616, Mar. 1983.) [steady and unsteady pressure measurements on pitching wing with 12 percent thick supercritical airfoil section]

14. Ricketts, R. H.; Sandford, M. C.; Watson, J. J.; and Seidel, D. A.: *Subsonic and Transonic Unsteady- and Steady-Pressure Measurements on a Rectangular Supercritical Wing Oscillated in Pitch*. NASA TM-85765, Aug. 1984. [steady and unsteady pressure measurements on pitching wing with 12 percent thick supercritical airfoil section]
15. Sandford, M. C.; Ricketts, R. H.; and Cazier, F. W, Jr.: *Transonic Steady and Unsteady Pressure Measurements on a High Aspect Ratio Supercritical Airfoil Model with Oscillating Control Surfaces*. NASA TM-81888, Dec. 1980. [high aspect ratio transport type wing model having 252 static pressure orifices and 164 in situ dynamic pressure gages]
16. Sandford, M. C.; Ricketts, R. H.; Cazier, F. W., Jr.; and Cunningham, H. J.: *Transonic Unsteady Airloads on an Energy Efficient Transport Wing with Oscillating Control Surfaces*. Journal of Aircraft, Vol. 18, No. 7, July 1981, pp. 557-561. (Originally AIAA Paper 1980-0738, 21st AIAA/ASME/ASCE/AHS Structures, Structural Dynamics, and Materials Conference, Seattle, WA, May 12-14, 1980; and NASA TM-81788, Mar. 1980.) [high aspect ratio transport type wing model having 252 static pressure orifices and 164 in situ dynamic pressure gages]
17. Sandford, Maynard C.; Ricketts, Rodney H.; and Watson, Judith J.: *Subsonic and Transonic Pressure Measurements on a High-Aspect-Ratio Supercritical-Wing Model with Oscillating Control Surfaces*. NASA TM-83201, Nov. 1981. [high aspect ratio transport type wing model having 252 static pressure orifices and 164 in situ dynamic pressure gages, Mach No. 0.60 and 0.78]
18. Sandford, Maynard C.; and Ricketts, Rodney H.: *Steady- and Unsteady-Pressure Measurements on a Supercritical-Wing Model with Oscillating Control Surfaces at Subsonic and Supersonic Speeds*. NASA TM-84543, Jan. 1983. [high aspect ratio transport type wing model having 252 static pressure orifices and 164 in situ dynamic pressure gages]
19. Sandford, Maynard C.; Seidel, David A.; Eckstrom, Clinton V.; and Spain, Charles V.: *Geometrical and Structural Properties of an Aeroelastic Research Wing (ARW-2).* NASA TM-4110, Apr. 1989. (Some additional information is given in: *Loads Calibrations of Strain Gage Bridges on the DAST Project Aeroelastic Research Wing.* NASA TM-87677, May 1986.) [provides information necessary for making calculations for DAST ARW-2 right wing, unsteady pressure test reported elsewhere]
20. Sandford, Maynard C.; Seidel, David A.; and Eckstrom, Clinton V.: *Steady Pressure Measurements on an Aeroelastic Research Wing (ARW-2)*. NASA TM-109046, Feb. 1994. [DAST ARW-2 right wing]
21. Scott, Robert C.; and Silva, Walter A.: *Pitch Oscillation Data and Analysis for a Large HSCT Semispan Wing.* International Forum on Aeroelasticity and Structural Dynamics 2003, Amsterdam, The Netherlands, June 4-6, 2003. [rigid wing on oscillating turntable, HSCT configuration]
22. Schuster, David M.; and Rausch, Russ D.: *Transonic Dynamics Tunnel Force and Pressure Data Acquired on the HSR Rigid Semispan Model.* Lockheed-Martin Engineering Services, ASR 96-07, Dec. 1996.
23. Schuster, D. M.; and Rausch, R. D.: *Transonic Dynamics Tunnel Force and Pressure Data Acquired on the HSR Rigid Semispan Model.* NASA CR 1999-209555, Sep. 1999.
24. Scott, Robert C.; Silva, Walter A.; Florance, James R.; and Keller, Donald F.: *Measure-*

ment of Unsteady Pressure Data on a Large HSCT Semispan Wing and Comparison with Analysis. AIAA Paper 2002-1648, 43rd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Denver, CO, Apr. 22-25, 2002. [model oscillated in pitch]

25. Seidel, D. A.: Sandford, M. C.; and Eckstrom, C. V.: *Measured Unsteady Transonic Aerodynamic Characteristics of an Elastic Supercritical Wing*. Journal of Aircraft, Vol. 24, No. 4, Apr. 1987, pp. 225-230. (Originally AIAA Paper 1985-0598, *Measured Unsteady Transonic Aerodynamic Characteristics of an Elastic Supercritical Wing with an Oscillating Control Surface*, 26th AIAA/ASME/ ASCE/AHS Structures, Structural Dynamics, and Materials Conference, Orlando, FL, Apr. 15-17, 1985; and NASA TM-86376, Feb. 1985.) [DAST ARW-2 right wing]
26. Seidel, David A.; Sandford, Maynard C.; and Eckstrom, Clinton V.: *Unsteady-Pressure and Dynamic-Deflection Measurements on an Aeroelastic Supercritical Wing*. NASA TM-4278, Dec. 1991. [DAST ARW-2 right wing]
27. Silva, Walter A.; Keller, Donald F.; Florance, James R.; Cole, Stanley R.; and Scott, Robert C.: *Experimental Steady and Unsteady Aerodynamic and Flutter Results for HSCT Semispan Models.* AIAA Paper 2000-1697, 41st AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Atlanta, GA, Apr. 3-6, 2000. [two HSR semispan models]
28. Silva, Walter A.; Piatak, David J.; and Scott, Robert C.: *Identification of Experimental Unsteady Aerodynamic Impulse Responses.* AIAA Paper 2003-1959, 44th AIAA/ASME/ ASCE/AHS Structures, Structural Dynamics, and Materials Conference, Conference, Norfolk, VA, Apr. 7-10, 2003.
29. Wieseman, Carol D.: Methodology for Matching Experimental and Computational Aerodynamic Data. AIAA Paper 1988-2392, 29th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Williamsburg, VA 18-20, Apr. 1988. (Also available as NASA TM-100592, May 1988, and described in NASA Tech Brief, Sep. 1993) [correction factors based on steady experimental or analytical data for adjusting both steady and unsteady data applied to rectangular supercritical wing model]

3.7.3 Steady Pressures and Forces

1. Alexander, Michael G.; Anders, Scott G.; Johnson, Stuart K.; Florance, Jennifer P.; and Keller, Donald F.: *Trailing Edge Blowing on a Two-Dimensional Six-Percent Thick Elliptical Circulation Control Airfoil Up to Transonic Conditions.* NASA TM-2005-213545, Mar. 2005. [model with end plate mounted on splitter plate]
2. DaForno, G.; and Bennett, R. M.: *Using Freon in Transonic Wind Tunnel Testing for Loads*. AIAA Paper 1982-0581, AIAA 12th Aerodynamic Testing Conference, Williamsburg, VA, Mar.21-24, 1982. [Grumman maneuver loads study]
3. Grosser, William F.: *A Transonic Speed Wind Tunnel Investigation of the Rolling Effectiveness of a Large Swept Wing Transport Aircraft with Conventional Type Ailerons and Various Spoiler Configurations.* AIAA Paper 1965-0789, AIAA/RAeS/JSASS Aircraft Design and Technology Meeting, Los Angeles, CA, Nov. 15-18, 1965. [C-5A model]
4. McMasters, J. H.; Roberts, W. H.; Payne, F. M.; Sandford, M. C.; and Durham, M.: *Recent Air-Freon Tests of a Transport Airplane in High Lift Configurations*. AIAA 15th Aerodynamic Testing Conference, San Diego, CA, May 18-20, 1988. [B737-300 airplane model, steady aerodynamics test]

5. Ray, Edward J.; and Taylor, Robert T.: *Effect of Configuration Variables on the Subsonic Longitudinal Stability Characteristics of a High-Tail Transport Configuration.* NASA-TM-X-1165, Oct. 1965. [steady aerodynamics test]
6. Taylor, Robert T.; and Ray, Edward J.: *Deep Stall Aerodynamic Characteristics of T-Tail Aircraft.* NASA Conference of Aircraft Operating Problems, Langley Research Center, NASA-SP-83, May 10-12, 1965, pp. 113-121. [steady aerodynamics test]
7. Treon, S. L.; Hofstetter, W. R.; and Abbott, F. T., Jr.: *On the Use of Freon-12 for Increasing Reynolds Number in Wind Tunnel Testing of Three-Dimensional Aircraft Models at Subcritical and Supercritical Mach Numbers*. Facilities and Techniques for Aerodynamic Testing at Transonic Speeds and High Reynolds Number, AGARD-CP-82, Aug. 1971, pp. 27-1—27-2. (Also available as NASA TM-X-67417, Aug. 1971.) [aerodynamic forces on sting-mounted, rigid models]
8. Watson, Judith J.: *Elastic Deformation Effects on Aerodynamic Characteristics for a High-Aspect-Ratio Supercritical-Wing Model.* NASA TM-83286, May 1982. [semi-span, high-aspect ratio wing with leading- and trailing edge control surfaces]
9. Weller, William H.: *Comparison of Aerodynamic Data Measured in Air and Freon-12 Wind-Tunnel Test Mediums.* NASA TM-78671, Mar. 1978. [two-dimensional model with NACA 65 series airfoil section]
10. Yates, E. Carson, Jr.; and Sandford, Maynard C.: *Static Longitudinal Aerodynamic Characteristics of an Elastic Canard-Fuselage Configuration as Measured in Air and in Freon-12 at Mach Number Up to 0.92.* NASA TN D-1792, July 1963. [NX-2 nuclear airplane design]

4.0 ROTORCRAFT

4 .1 Surveys/Overviews

1. Kvaternik, Raymond G.: *Experimental and Analytical Studies in Tilt-Rotor Aeroelasticity.* NASA and AHS Conference on Rotorcraft Dynamics, Moffett Field, CA, Feb. 13-15, 1974, NASA SP-352, 1974, pp. 171-184. [selected results from several tests in TDT as well as some conducted elsewhere]
2. Kvaternik, Raymond G.: *A Review of Some Tilt-Rotor Aeroelastic Research at NASA Langley*. Journal of Aircraft, Vol. 13, No 5, May 1976, pp. 357-363. [Bell Model 266, Bell Model 300 (XV-15), Grumman Helicat]
3. Kvaternik, Raymond G.: *A Historical Overview of Tilt-Rotor Aeroelastic Research at Langley Research Center*. NASA TM-107578, Apr. 1992. [Bell Model 266, Grumman Helicat, Bell Model 300 (XV-15), JVX (V-22)]
4. Huston, Robert J.; and Ward, John F.: *A Summary of Hingeless-Rotor Research at NASA Langley*. 20th AHS Annual Forum, Washington, D.C., May13-15. 1964. (Also available as NASA TM-X-51513, 1965.) [three-blade matched-stiffness rotor, aerodynamic and structural loads; three, four, and six blade low drag rotors]
5. Ormiston, Robert A.; Warmbrodt, William G.; Hodges, Dewey H.; and Peters, David A.: *Rotorcraft Aeroelastic Stability.* NASA/Army Rotorcraft Technology Conference, NASA Ames Research Center, CA, Mar. 17-19, 1987, NASA CP-2495-Vol. I, 1988, pp. 353-529. [lengthy paper that reviews all aspect of aeroelastic and aeromechanical stabil-

ity of helicopter and tiltrotor aircraft, specifically cites tests of Bell Model 266, V-22 Osprey, Model 652 Rotor, and tiltrotor research model]

6. Ward, John F.: *A Summary of Hingeless-Rotor Structural Loads and Dynamics Research*. Symposium on the Noise and Loading Actions on Helicopter VF/STOL Aircraft and Ground Effects Machines, University of Southampton, Southampton, England. Aug. 30-Sep. 3, 1965. [mostly non-TDT research but does highlight three-blade hingeless-rotor models tested therein]
7. Wilson, John C.: *Accomplishments at NASA Langley Research Center in Rotorcraft Aerodynamics Technology.* NASA/Army Rotorcraft Technology Conference, NASA Ames Research Center, CA, Mar. 17-19, 1987, NASA CP-2495-Vol. I, 1988, pp. 7-33. [a general review that mentions some work accomplished at the TDT]
8. Yeager, William T., Jr.; and Kvaternik, Raymond G.: *Contributions of the Langley Transonic Dynamics Tunnel to Rotorcraft Technology and Development.* AIAA Paper 2000-1771, AIAA Dynamics Specialists Conference, Atlanta, GA, Apr. 5-6, 2000.
9. Yeager, William T., Jr.; and Kvaternik, Raymond G.: *A Historical overview of Aeroelasticity Branch and Transonic Dynamics Tunnel Contributions to Rotorcraft Technology and Development.* NASA TM-2001-211064 and U. S. Army ARL-TR-2564, Aug. 2001. [a comprehensive review of helicopter and tiltrotor testing from beginning to date of publication, expanded version of AIAA Paper 2000-1771]
10. Yeager, William T., Jr.; Wilbur, Matthew L.; and Nixon, Mark W.: *A Review of Recent Rotorcraft Investigations in the Langley TDT.* AIAA Paper 2003-1963, 44th AIAA/ASME/ASCE/AHS Structures, Structural Dynamics, and Materials Conference, Norfolk, VA, Apr. 7-10, 2003. [descriptions of ARES and WRATS, active twist rotor, soft-inplane tiltrotor]
11. Yeager, William T., Jr.; Hamouda, M-Nabil H.; Idol, Robert F.; Mirick, Paul H.; Singleton, Jeffrey D.; and Wilbur, Matthew L.: *Vibratory Loads Data from a Wind-Tunnel Test of Structurally Tailored Model Helicopter Rotors.* NASA TM-4265 and U. S. Army AVSCOM-TR-91-B-001, Aug, 1991. [three sets of 1/5-size Mach-scaled four-bladed rotor blades on bearingless hub]
12. Yeager, W. T., Jr.; Mirick, P. H.; Wilbur, M. L.; Singleton, J. D.; Wilkie, W. K.; and Hamouda, M.-N. H: *Rotorcraft Aeroelastic Testing in the Langley Transonic Dynamics Tunnel.* Journal of the AHS, Vol. 38 (3), July 1993, pp. 73-82. (Originally: *Recent Rotorcraft Aeroelastic Testing in the Langley Transonic Dynamics Tunnel*, 47th AHS Annual Forum, Phoenix, AZ, May 6-8, 1991.)

4.2 Helicopters

1. Blackwell, R. H.; Murrill, R. J.; Yeager, W. T., Jr.; and Mirick, P. H.: *Wind-Tunnel Evaluation of Aeroelastically Conformable Rotors*. AHS 36th Annual Forum, Washington, D. C., May 13-14, 1980. [initial aeroelastically conformable rotor tests]
2. Brooks, Thomas F.; and Booth, Earl R., Jr.: *Rotor Blade-Vortex Interaction Noise Reduction and Vibration Using Higher Harmonic Control.* 16th European Rotorcraft Forum, Paper No. 9.3, Glasgow, U.K., Sep. 1990.
3. Brooks, Thomas F.; Booth, Earl R., Jr.; Jolly, J. Ralph, Jr.; Yeager, William T., Jr.; and Wilbur, Matthew L.: *Reduction of Blade-Vortex Interaction Noise Using Higher Harmonic Pitch Control.* NASA TM-101624 and U. S. Army AVSCOM TM 89-B-005,

July 1989. [acoustic test using a four-bladed, articulated rotor model]

4. Brooks, Thomas F.; Booth, Earl R., Jr.; Jolly, J. Ralph, Jr.; Yeager, William T., Jr.; and Wilbur, Matthew L.: *Reduction of Blade-Vortex Interaction Noise Through Higher Harmonic Pitch Control.* Journal of the AHS, Jan. 1990, pp. 86-91. (Originally: *Reduction of Blade-Vortex Interaction Noise Using Higher Harmonic Pitch Control*, U S. Army AVSCOM TM 89-B-005, and NASA TM-101624, July 1989.) [four-bladed articulated rotor with higher harmonic pitch control]
5. Booth, Earl R., Jr.; and Wilbur, Matthew L.: *Acoustic Aspects of Active-Twist Rotor Control.* Journal of the AHS, Jan. 2004, pp. 3-10. (Originally presented at 58th AHS Annual Forum, Montréal, Canada, June 11-13, 2002.)
6. Cesnik, C. E. S.; Shin, S.; Wilkie, W. K.; Wilbur, M. L.; and Mirick, P. H.: *Modeling, Design, and Testing of the NASA/Army/MIT Active Twist Rotor Prototype Blade*. 55th AHS Annual Forum, Montréal, Canada, May 25-27, 1999.
7. Cesnik, Carlos E. S.; Shin, Sangjoon; Wilbur, Matthew L.; and Wilkie, W. Keats: *Design and Testing of the NASA/Army/MIT Active Twist Rotor Prototype Blade.* 26th European Rotorcraft Forum, The Hague, The Netherlands, Sep. 2000.
8. Drees, J. M.: *The Art and Science of Rotary Wing Data Correlation.* Journal of the AHS, Vol., 21, July 1976, pp. 2-12. (Previously presented at AGARD Symposium on Flight/ Ground Testing Facilities Correlation, Valloire and Modane, Savoie, France, June 1975.] [aeroelastically scaled 1/3-size hingeless rotor]
9. Fogarty, David E.; Wilbur, Matthew L.; Sekula, Martin K.: *Prediction of BVI Noise for an Active Test Rotor Using Loosely Coupled CFD/CSD Method and Comparison to Experimental Data.* 68th AHS Annual Forum, Fort Worth, TX, May 1-3, 2012. [application of two methods to compute rotor blade aerodynamics and elastic blade motion]
10. Hammond, C. E.: *Wind Tunnel Results Showing Rotor Vibratory Loads Reduction using Higher Harmonic Blade Pitch*. Journal of the AHS, Vol. 28, No. 1, Jan. 1983, pp. 10-15. (Originally: Preprint No. 80-66, 36th AHS Annual Forum, May 13-14, 1980)
11. Hammond, C. E.; and Weller, W. H.: *Wind-Tunnel Testing of Aeroelastically Scaled Helicopter Rotor Models.* Presented at 1976 Army Science Conference, West Point, NY, June 22-25, 1976.
12. Hanson, T. F.: *Investigation of Elastic Coupling Phenomena of High-Speed Rigid Rotor Systems.* U. S. Army-REECOM Technical Report 63-75 (Lockheed-California Company, Contract DA 44-177-TC-929) , Mar. 1964. [three-bladed hingeless rotor, conventional helicopter and compound helicopter modes]
13. Hanson, T. F.: *Wind Tunnel Tests of an Optimized, Matched-Stiffness Rigid Rotor*. U. S. Army-REECOM Technical Report 64-56 (Lockheed-California Company, Contract DA 44-177-AMC-.78T), Nov. 1964. [optimized three-bladed hingeless rotor]
14. Lake, R. C.; Nixon, M. W.; Singleton, J. D.; and Mirick, P. H.: *Demonstration of an Elastically Coupled Twist Control Concept for Tilt Rotor Blade Application.* Technical Notes, AIAA Journal, Vol. 32, No. 7, July 1994, pp. 1549-1551. (Originally, *A Demonstration of Passive Blade Twist Control Using Extension-Twist Coupling,* AIAA Paper 1992-2468, 33rd Structures, Structural Dynamics, and Materials Conference, Dallas, TX, Apr. 13-15, 1992; and NASA TM-107642, and U. S. Army AVSCOM TR 92-B-010, June 1992.)

15. Lee, C. D.; and White, J. A.: *Investigation of the Effect of Hub Support Parameters on Two-Bladed Rotor Oscillatory Loads.* NASA CR-132435 (Contract NAS1-11352, Bell Helicopter Co.), May 1974. [two-bladed teetering rotor]

16. Mantay, W. R.; and Yeager, W. T., Jr.: *Aeroelastic Considerations for Torsionally Soft Rotors*. AHS 2nd Decennial Specialists Meeting on Rotorcraft Dynamics, Ames Research Center, Moffett Field, CA, Nov. 7-9, 1984. (Also available as NASA TM-87687 and as U. S. Army AVSCOM TR-86-B-1, Aug. 1986) [effects of variations in tip geometry on conformable rotor performance and loads]

17. Mantay, W. R.; Yeager, W. T., Jr.; Hamouda, M-Nabil; Cramer, R. G., Jr.; and Langston, C. W.: *Aeroelastic Model Helicopter Rotor Testing in the Langley TDT.* AHS Specialists Meeting on Helicopter Test Methodology, Williamsburg, VA, Oct. 29-Nov. 1, 1984. (Also available as NASA TM-86440, July 1985.) [describes all aspect of helicopter rotor testing including facility uniqueness, model scaling, advantages of Freon test medium, and description of ARES]

18. Mantay, Wayne R.; and Yeager, William T., Jr.*: Parametric Tip Effects for Conformable Rotor Applications.* IAC Ninth European Rotorcraft Forum, Stressa, Italy Sep. 13-15, 1983. (Also available as NASA TM-85682 and as U. S. Army AVRADCOM-TR-83-B-4, Aug. 1983.) [effects of parametric changes in blade tip geometry on loads and performance of aeroelastically conformable rotor]

19. Massey, S. J.; Kreshock, Andrew R.; and Sekula, Martin K.: *Coupled CFD/CSD Analysis of an Active-Twist Rotor in a Wind Tunnel with Experimental Validations.* 71st AHS Annual Forum, Virginia Beach, VA, May 5-7, 2015.

20. Noonan, Kevin W.; Yeager, William T., Jr.; Singleton, Jeffrey D.; Wilbur, Matthew L.; and Mirick, Paul H: *Evaluation of Model Helicopter Main Rotor Blade with Slotted Airfoils at the Tip.* 55th AHS Annual Forum, Montréal, Canada, May 25-27, 1999.

21. Pritchard, Jocelyn I.; Adelman, Howard M.; Walsh, Joanne; Wilbur, Matthew L.: *Optimizing Tuning Masses for Helicopter Rotor Blade Vibration Reduction Including Computed Airloads and Comparison with Test Data.* Journal of Aircraft, Vol. 30, No. 6, Nov.-Dec. 1993, pp. 906-910. (Originally AIAA Paper 1992-2376, 33rd AIAA/ASME/ASCE/AHS Structures, Structural Dynamics, and Materials Conference, Dallas, TX, Apr. 13-15, 1992; and NASA TM-104194, Jan. 1992.) [applied to one-sixth, Mach-scaled rotor blade mode]

22. Shin, Sangjoon; Cesnik, Carlos E. S.; and Wilbur, Matthew L.: *Dynamic Response of Active Twist Rotor Blades.* AIAA Paper 2000-1711, 41st AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Atlanta, GA, Apr. 3-6, 2000. [four blade rotor with one active twist blade]

23. Shin, Sangjoon; Cesnik, Carlos E. S.; and Wilbur, Matthew L.: *Forward Flight Response of Active Twist Rotor for Helicopter Vibration Reduction.* AIAA Paper 2001-1357, AIAA/ASME/AHS Adaptive Structures Forum, Seattle, WA, Apr. 16-19, 2001. [four blade active twist rotor system]

24. Singleton, Jeffrey D.; and Yeager, William T., Jr.: *Important Scaling Parameters for Testing Model-Scale Helicopter Rotor.* Journal of Aircraft, Vol. 37, No. 3, May-June 2000, pp 396-402. (Originally, AIAA Paper 1998-2881, 20th AIAA Advanced Measurements and Ground Testing Technology Conference, Albuquerque, NM, June 15-18,

1988.) [effects of varying Reynolds number, blade Lock number, and structural elasticity on blade performance]

25. Singleton, Jeffrey D.; Yeager, William T., Jr.; and Wilbur, Matthew L.: *Performance Data from a Wind-Tunnel Test of Two Main Rotor Blade Designs for a Utility Class Helicopter*. NASA TM-4183 and U. S. Army AVSCOM TM 90-B-004, June 1990. ["rigid" blade set and dynamically scaled blade set, UH-60A Blackhawk]
26. Weller, William H.: *Load and Stability Measurements on a Soft-Inplane Rotor System Incorporating Elastomeric Lead-Lag Dampers.* NASA TN-D-8437, July, 1977. [1/5-scale aeroelastic model of four-blade rotor]
27. Weller William H.: *Experimental Investigation of Effects of Blade Tip Geometry on Loads and Performance for an Articulated Rotor System.* NASA TP-1303 and U. S. Army AVRADCOM-TR-78-53, Jan. 1979. [effects four variations in trip geometry evaluated]
28. Wilbur, Matthew L.: *Experimental Investigation of Helicopter Vibration Reduction Using Rotor Blade Aeroelastic Tailoring.* 47th AHS Annual Forum, Phoenix, AZ, May 6-8, 1991.
29. Wilbur, Matthew L.; *Development of a Rotor-Body Coupled Analysis for an Active Mount Aeroelastic Rotor Testbed.* NASA TP-1998-208433 and U. S. Army ARL-TR-1313, June 1998. (based on Master of Science Thesis, George Washington University, Washington, D. C., May 1996) [coupling aeroelastically scaled model rotor system to second generation ARES]
30. Wilbur, Matthew L.; Yeager, William T., Jr.; Singleton, Jeffrey D.; Mirick, Paul H.; and Wilkie, W. Keats: *Wind-Tunnel Evaluation of the Effect of Blade Nonstructural Mass Distribution on Helicopter Fixed-System Loads*. NASA TM-1988-206281, Jan. 1998. [four-blade generic rotor system on ARES]
31. Wilbur, Matthew L.; Yeager, William T., Jr.; Wilkie, W. Keats; Cesnik, Carlos E. S.; and Shin, Sangjoon: *Hover Testing of the NASA/Army/MIT Active Twist Rotor Prototype Blade.* 56th AHS Annual Forum, Virginia Beach, VA, May 2-4, 2000.
32. Wilbur, Matthew L.; Mirick, Paul H.; Yeager, William T., Jr.; Langston, Chester W.; Cesnik, Carlos, E. S.; and Shin, Sangjoon: *Vibratory Loads Reduction Testing of the NASA/Army/MIT Active Twist Rotor.* Journal of the AHS, Apr. 2002, pp. 123-133. (Originally presented at 57th AHS Annual Forum, Washington, D. C., May 9-10, 2001.)
33. Wilbur, Matthew L., Yeager, William T., Jr.; and Sekula, Martin K.: *Further Examination of the Vibratory Loads Reduction Results from the NASA/Army/MIT Active Twist Rotor Test.* 58th AHS Annual Forum, Montréal, Canada, June 11-13, 2002. (Also presented at 28th European Rotorcraft Forum, Bristol, England, UK, Sep. 2002.)
34. Wilkie, W. Keats; Langston, Chester W.; Mirick, Paul H.; Singleton, Jeffrey D.; Wilbur, Matthew L.; and Yeager, William T., Jr.: *An Experimental Study of the Sensitivity of Helicopter Rotor Blade Tracking to Root Pitch Adjustment in Hover.* NASA TM-4313, and AVSCOM TR 91-B-017, Dec. 1991. [test conducted in Langley Helicopter Hover Facility which is often used for checking out rotorcraft model prior to entry into the TDT]
35. Wilkie, W. Keats; Mirick, Paul H.; and Langston, Chester W.: *Rotating Shake Test and Modal Analysis of a Model Helicopter Rotor Blade.* NASA TM-4760, June 1997. [generic rotor blades mounted to ARES, test conducted in Helicopter Hover Facility

adjacent to TDT]

36. Wood, E. R.; Powers, R. W.; Cline, J. H.; and Hammond, C. E.: *On Developing and Flight Testing a Higher Harmonic Control System*. Journal of the AHS, Vol. 30, No. 1, Jan. 1985, pp. 3-20. [HHC concept developed during TDT testing]
37. Yeager, William T., Jr.; and Mantay, Wayne R.: *Correlation of Full-Scale Helicopter Rotor Performance in Air with Model-Scale Freon Data.* NASA TN D-8323, Nov. 1976. [compares data from 1/5-scale model rotor in Freon to corresponding data from full-scale rotor in air]
38. Yeager, W. T., Jr.: and Mantay, Wayne R.: *Wind-Tunnel Investigation of the Effects of Blade Tip Geometry on the Interaction of Torsional Loads and Performance for an Articulated Helicopter Rotor*. NASA TP-1926, and U. S. Army AVRADCOM-TR-81-B-5, Dec. 1981. [four blade rotor configuration, variations in tip geometry, and advance ratio]
39. Yeager, W. T.; and Mantay, W. R.: *Loads and Performance Data from a Wind-tunnel Test of Model Articulated Helicopter Rotors with Two Different Blade Torsional Stiffnesses*. NASA TM-84573, and U. S. Army AVRADCOM TP 82-B-9, Apr. 1983. [passive tailoring for improving rotor performance and reducing loads]
40. Yeager, William T., Jr.; Mantay, Wayne R.; and Hamouda, M-Nabil: *Aeromechanical Stability of a Hingeless Rotor in Hover and Forward Flight: Analysis and Wind Tunnel Tests*. IAC Ninth European Rotorcraft Forum, Sep. 13-15, 1983, Stressa, Italy. (Also available as NASA TM-85683, Aug. 1983.)
41. Yeager, William T., Jr.; Hamouda, M-Nabil; and Mantay, Wayne R.: *An Experimental Investigation of the Aeromechanical Stability of a Hingeless Rotor in Hover and Forward Flight*. NASA TM-89107, and U. S. Army AVSCOM TM 87-B-5, June 1987. [aeromechanical stability of soft in-plane hingeless rotor model]
42. Yeager, W. T.; Mantay, W. R.; Wilbur, M. L.; Cramer, R. G., Jr.; and Singleton, J. D.: *Wind Tunnel Evaluation of an Advanced Main-Rotor Design for a Utility-Class Helicopter*. U. S. Army AVSCOM TM 87-B-8, and NASA TM-89129, Sep. 1987. [compares performance and loads of present main rotor design with advanced design in hover and forward flight]
43. Yeager, William T., Jr.; Hamouda, M-Nabil; Idol, Robert; Mirick, Paul H.; Singleton, Jeffrey D.; and Wilbur, Matthew L.: *Vibratory Loads Data from a Wind-Tunnel Test of a Structurally Tailored Model Helicopter Rotor.* NASA TM-4625, and U. S. Army AVSCOM TR 91-B-001, Aug. 1991.
44. Yeager, William T., Jr.; Noonan, Kevin W.; Singleton, Jeffrey D.; Wilbur, Matthew L.; and Mirick, Paul H.: *Performance and Vibratory Loads Data from Wind-Tunnel Test of a Model Helicopter Main-Rotor Blade with a Paddle-Type Tip*. NASA TM-4754, U. S. Army ARL Technical Report 1283, and U. S. Army ATCOM Technical Report 97-A-006, May 1997. [baseline and paddle-type tip blades compared, performance and loads]
45. Yeager, William T., Jr.; and Wilbur, Matthew L.: *Loads and Performance Data from a Wind-Tunnel Test of Generic Model Helicopter Rotor Blades.* NASA TP-2005-213937, and U. S. Army ARL-TR-3675, Nov. 2005.

4.3 Tiltrotors

1. Gaffey, T. M.; Yen, J. G.; and Kvaternik, R. G.: *Analysis and Model Tests of the Proprotor Dynamics of a Tilt-Proprotor VTOL Aircraft.* Air Force V/STOL Technology and Planning Conference, Las Vegas, NV, Sep. 23-25, 1969. [Bell Model 266]
2. Kvaternik, Raymond G.: *Studies in Tiltrotor VTOL Aircraft Aeroelasticity*. Ph.D. Dissertation, Case Western Reserve University, June 1973. (Available in two volumes as NASA TM X-69497 (Vol. I) and NASA TM X-69496 (Vol. II), June 1973.) [0.1333-scale model of Bell Model 266 and 0.20-scale model of Bell Model 300 tiltrotor designs]
3. Kvaternik, Raymond G.; and Kohn, Jerome S.: *An Experimental and Analytical Investigation of Proprotor Whirl Flutter*. NASA TP-1047, Dec. 1977. [Grumman Helicat]
4. Kvaternik, Raymond, G.; Piatak, David J.; Nixon, Mark W.; Langston, Chester W.; Singleton, Jeffrey D.; Bennett, Richard L.; and Brown, Ross K.: *An Experimental Evaluation of Generalized Predictive Control for Tiltrotor Aeroelasticity Stability Augmentation in Airplane Mode of Flight.* Journal of the AHS, Vol. 47, No. 3, July 2002, p. 198ff. (Originally presented at 57th AHS Annual Forum, Washington, D. C., 9-11 May 2001.)
5. Nixon, Mark W.; Kvaternik, Raymond G.; and Settle, T. Ben: *Tiltrotor Vibration Reduction through Higher Harmonic Control.* Journal of the AHS, Vol. 43, No. 3, July 1998, p. 235ff. (Originally presented at 53rd AHS Annual Forum, Virginia Beach, VA, Apr. 29-May 1, 1997, available as NASA TM-112427, Apr. 1997.) [WRATS, application of HHC to tiltrotor]
6. Nixon, Mark W.; Kvaternik, Raymond G.; and Settle, T. Ben: *Higher Harmonic Control for Tiltrotor Vibration Reduction*. CEAS International Forum on Aeroelasticity and Structural Dynamics, Rome, Italy, June 17-20, 1997. [WRATS, application of HHC to tiltrotor]
7. Nixon, Mark W.; Langston, Chester W.; Singleton, Jeffrey D.; Piatak, David J.; Kvaternik, Raymond G.; Corso, Lawrence M.; and Brown, Ross K.: *Hover Tests of a Soft-Inplane Gimbaled Tiltrotor Model.* Technical Note, Journal of the AHS, Vol. 48, No. 1, Jan. 2003, p. 63ff.
8. Nixon, Mark W.; Langston, Chester W.; Singleton, Jeffrey D.; Piatak, David J.; Kvaternik, Raymond G.; Corso, Lawrence M.; and Brown, Ross K.: *Aeroelastic Stability of a Four-Bladed Semi-Articulated Soft-Inplane Tiltrotor Model.* 59th AHS Annual Forum, Phoenix, Arizona, May 6-8, 2003. (Also presented at 2003 International Forum on Aeroelasticity and Structural Dynamics, Amsterdam, The Netherlands, June 4-6, 2003.)
9. Nixon, Mark W.; Langston, Chester W.; Singleton, Jeffrey D.; Piatak, David J.; Kvaternik, Raymond G.; Bennett, Richard L.; and Brown, Ross K.: *Experimental Investigations of Generalized Predictive Control for Tiltrotor Stability Augmentation.* 2001 CEAS International Forum on Aeroelasticity and Structural Dynamics, Madrid, Spain, June 5-7, 2001.
10. Piatak, David J.; and Kunz, Donald L.: *Experimental Investigation of a Fullspan Tiltrotor Model with Higher Harmonic Vibration Control.* Eighth ARO Workshop on Aeroelasticity of Rotorcraft Systems, State College, Pa., Oct. 17-20, 1999.
11. Piatak, David J.; Kvaternik, Raymond G.; Nixon, Mark W.; Langston, Chester W.; Singleton, Jeffrey D.; Bennett, Richard L.; and Brown, Ross K.: *A Parametric Investiga-*

tion of Whirl-Flutter Stability on the WRATS Tiltrotor Model. Journal of the AHS, Vol. 47, No. 2, April 2002, pp. 134-144.

12. Soistmann, David L.: *An Experimental and Analytical Investigation of Wing Flutter on a Trail Rotor V/STOL Aircraft.* AIAA Paper 1992-2112, AIAA Dynamic Specialists Conference, Dallas, TX, Apr. 16-17, 1992. [semi-span, cantilevered research wing]

5.0 LAUNCH VEHICLES AND SPACECRAFT

5.1 Surveys/Overviews

1. Cole, Stanley R.; Keller, Donald F.; and Piatak, David J.: *Contributions of the Transonic Dynamics Tunnel to Launch Vehicle and Spacecraft Development.* AIAA Paper 2000-1772, AIAA Dynamics Specialists Conference, Atlanta, GA, Apr. 5-6, 2000 Atlanta, GA. [a comprehensive review of Launch Vehicle and Spacecraft related tests up to 2000]
2. Farmer, Moses G.; and Jones, G. W., Jr.: *Summary of Langley Wind Tunnel Studies of Ground-Wind Loads Launch Vehicles.* Meeting on Ground Wind Loads Problems in Relation to Launch Vehicles, NASA Langley Research Center, Compilation of Papers Presented at the NASA Langley Research Center, June 7-8, 1966, NASA TM X-57779, June 1966, pp. 2.1-2.25. [Scout, Jupiter, Saturn I (Block I and Block II), Titan III, Titan Gemini, Saturn IB, Saturn V]

5.2 Launch Vehicles

1. Pinier, Jeremy T.; Blevins, John A.; Erickson, Gary E.; Favaregh, Noah M.; Houlden, Heather P.; and Tomek, William G.: *Space Launch System Ascent Static Aerodynamic Database Development.* AIAA Paper 2014-1254, 52nd AIAA Aerospace Sciences Meeting, National Harbor, MD, Jan. 13-17, 2014. [configuration SLS-10003, primarily results from Boeing Polysonic Wind Tunnel Facility, limited amount of data from 0.8-scale sting-mounted model in TDT]
2. Schuster, David M.; and Pinier, Jeremy T.: *Transonic Shock Reflections in Space Launch System (SLS) Wind Tunnel Testing.* NASA/TM-2014-218269 and NESDC-RP-13-00862, May 2014. [configuration SLS-10003]

5.2.1 Buffeting

1. Cole, Stanley R.; and Henning, Thomas L.: *Buffet Response of a Hammerhead Launch Vehicle Wind-Tunnel Model.* Journal of Spacecraft and Rockets, Vol. 29, No. 3, May-June 1992, pp. 379-385. (Originally AIAA Paper 1991-1050, *Dynamic Response of a Hammerhead Launch Vehicle Wind-Tunnel Model*, 32nd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Baltimore, MD, Apr. 8-10, 1991, and NASA TM-104050, Feb. 1991.) [used partial mode test technique]
2. Byrdsong, Thomas A.; and Foughner, Jerome T., Jr.: *Buffet Investigation of a 1/8-Scale Model of a Proposed Project Fire Space Vehicle*. Memorandum for Files, Aeroelasticity Branch, NASA Langley Research Center, Oct. 9, 1962. [A copy of this memorandum, which is in the form of an unpublished technical report, is available in the TDT archives, nose cone with spacecraft models in various orientations]
3. Doggett, Robert V., Jr.; and Hanson, Perry W.: *Preliminary Results of the Saturn-Apollo 8-% Scale Aeroelastic Model Studies*. Conference on Apollo/Saturn Aeroelastic and Acoustic Investigations, Manned Spaceflight Center, Houston, TX, Mar. 1963. [Saturn Dynamics 1 Model (SD-1), buffeting response and aerodynamic damping]

4. Hanson, Perry W.; and Doggett, Robert V., Jr.: *Aerodynamic Damping and Buffet Response of an Aeroelastic Model of the Saturn I Block II Launch Vehicle*. NASA TN D-2713, Mar. 1965. [Saturn Dynamics 1 Model (SD-1), buffeting response and aerodynamic damping]
5. Jones, George W., Jr.; and Foughner, Jerome T., Jr.: *Investigation of Buffet Pressures on Models of Large Manned Launch Vehicle Configurations*. NASA TN D-1633, May 1963. [different size models tested in air and Freon 12, verification of scaling parameters]
6. Piatak, David J.; Florance, Jennifer Pinkerton; Ivanco, Thomas G.; Sekula, Martin K.; and Wieseman, Carol D. : *Test Summary Document for the 3.5% Ares I-X Rigid Buffet Model—Transonic Dynamics Tunnel Test 599.* Document No. ARES-AE-TA-0002, NASA Langley Research Center, Hampton, VA, July 2008. [buffeting pressures]
7. Piatak, David J.: *3.5% Ares I-X Rigid Buffet Model Full-Scale Buffet Forcing Function Database—Transonic Dynamics Tunnel Test 599.* Document No. ARES-AE-TA-0005, NASA Langley Research Center, Hampton, VA, Aug. 2008. [buffeting pressures]
8. Piatak, David J.; Sekula, Martin K.; Kwa, Teck-Seng; Ramey, James M.; Rausch, Russ D.; Selby, Gregory V.; and Stegall, David E.: *Test Summary Document for the 3.5% Ares I Rigid Buffet Model: TDT Test 605.* ARES-AE-TA-0012, NASA Langley Research Center, Hampton, VA, Oct. 2009. [buffeting pressures]
9. Piatak, David J.; Sekula, Martin K.; Kwa, Teck-Seng; Ramey, James M.; Rausch, Russ D.; Selby, Gregory V.; Stegall, David E.; and Wieseman, Carol D.: *Data Analysis and Results Document for the 3.5 Percent Ares I Rigid Buffet Model.* ARES-AE-TA-0013, NASA Langley Research Center, Hampton, VA, Oct. 2009. [rigid buffet pressure model]
10. Piatak, David J.; Sekula, Martin K.; and Rausch, Russ D.: *Ares Launch Vehicle Transonic Buffet Testing and Analysis Techniques.* Journal of Spacecraft and Rockets, Vol. 49, No. 5, Sep.-Oct. 2012, pp. 798-807. (Originally AIAA Paper 2010-4369, 28th AIAA Applied Aerodynamics Conference, Chicago, IL, June 28-July 1, 2010. [rigid buffet pressure model]
11. Piatak, David J.; Sekula, Martin K.; and Rausch, Russ D.: *Comparison of Ares I-X Wind-Tunnel-Derived Buffet Environment with Flight Data.* Journal of Spacecraft and Rockets, Vol. 49, No. 5, Sep.-Oct. 2012, pp. 822-833. (Originally AIAA Paper 2011-3013, 29th AIAA Applied Aerodynamics Conference, Honolulu, HI, June 27-30, 2011.) [flight data compared to results from rigid buffet pressure model]
12. Piatak, David J.; Sekula, Martin K.; Rausch, Russ D.; Florence, James R.; and Ivanco, Thomas G.: *Overview of the Space Launch System Transonic Buffet Environment.* AIAA Paper 2015-0557, 53rd AIAA Aerospace Sciences Meeting, Kissimmee, FL, Jan. 5-9, 2015. [Space Launch System (SLS) buffeting pressures, rigid buffet pressure model]
13. Piatak, David J.; Sekula, Martin K.; Rausch, Russ D.; Florance, James R.; and Ivanco, Thomas G.: *Initial Assessment of Space Launch System Transonic Unsteady Pressure Environment.* AIAA Paper 2015-0558, 53rd AIAA Aerospace Sciences Meeting, Kissimmee, FL, Jan. 5-9, 2015. [Space Launch System (SLS) 10000 buffeting pressures]
14. Rainey, A. Gerald: *Progress on the Launch-Vehicle Buffeting Problem*. 5th AIAA Structures and Materials Conference, Palm Springs, CA, Apr. 1-3, 1964, AIAA Publication CP-8, pp. 163-177. [Saturn Dynamics 1 Model (SD-1)]

15. Sekula, Martin K.; Piatak, David J.; and Rausch, Russ D.: *Analysis of Ares Crew Launch Vehicle Transonic Alternating Flow Phenomenon.* Journal of Spacecraft and Rockets, Vol. 49, No. 5, Sep.-Oct. 2012, pp.788-797. (Originally AIAA Paper 2010-4370, *Analysis of a Transonic Alternating Flow Phenomenon Observed during Ares Crew Launch Vehicle Wind Tunnel Tests*, 28th AIAA Applied Aerodynamics Conference, Chicago, IL, June 28-July 1, 2010.) [Ares I-X rigid buffet model buffeting pressures]
16. Sekula, Martin K.; Piatak, David J.; Rausch Russ D.; Florance, James R.; and Ramey, James M.: *Initial Assessment of Space Launch System Transonic Unsteady pressure Environment.* AIAA Paper 2015-0558, AIAA 53rd Aerospace Sciences Meeting, Kissimmee, FL, Jan. 5-9, 2015. [variations of Space Launch System (SLS) 10000 configuration]

5.2.2 Ground Wind Loads

1. Cincotta, J. J.; and Lambert, W. H.: *Investigation of Wind-Induced Oscillations and Steady Ground Wind Forces on a 7.5% Dynamically Scaled Model of the 624A Vehicle*. Aerospace Division of Martin-Marietta Corporation, Report SSD-CR-63-118, Denver, CO, Aug. 1963. [Titan III, 7.5-percent aeroelastic model]
2. Cincotta, Joseph J.; Jones, George W., Jr.; and Walker, Robert W.: *Experimental Investigation of Wind Induced Oscillation Effect on Cylinders in Two-Dimensional Flow at High Reynolds Numbers*. Meeting on Ground Wind Loads Problems in Relation to Launch Vehicles, NASA Langley Research Center, Compilation of Papers Presented at the NASA Langley Research Center, June 7-8, 1966, NASA TM X-57779, June 1966, pp. 20.1-20-35. [wall-to-wall oscillating (two dimensional) cylinder]
3. Farmer, Moses G.; and Jones, George W., Jr.: *Measured Pressure Distribution Around a Two-Dimensional Circular Cylinder at High Reynolds Number*. NASA Langley Working Paper (LWP)-170, Dec. 1965. [wall-to-wall (two dimensional) cylinder]
4. Farmer, Moses G.; and Reed, Wilmer H., III: *Study of Wind Excited Oscillations of High Band Wullenwebber Antenna*. NASA Langley Working Paper (LWP)-324, Nov. 1966. [antenna problem similar to launch vehicle ground wind loads]
5. Foughner, Jerome T., Jr.; and Duncan, Rodney L.: *A Full-Scale Ground Wind Load Program.* Meeting on Ground Wind Load Problems in Relation to Launch Vehicles, Compilation of Papers Presented at the NASA Langley Research Center, June 7-8, 1966, NASA TM X-57779, June 1966, pp. 4.1-4.19. [comparison of full-scale and model data for Jupiter configuration]
6. Ivanco, T. G.; and Keller, D. F.: *Database Release, Ground Wind Loads Checkout Model, Transonic Dynamics Tunnel Test 595.* ARES-AE-TA-0003, Apr. 2008. [Ares launch vehicle model]
7. Ivanco, T. G.; and Keller, D. F.: *Ares I-X Ground Wind Loads Database Release—Transonic Dynamics Tunnel Test 604.* ARES-AE-TA-0008, Mar. 2009. [Ares launch vehicle model]
8. Ivanco, T. G.; and Keller, D. F. : *Ares I-X Ground Wind Loads Database Release and Data Analysis Report.* ARES-AE-TA-0007, Apr. 2009. [Ares launch vehicle model]
9. Ivanco, Thomas G.; and Keller, Donald F.: *Wind Tunnel Investigation of Ground Wind Loads for Ares Launch Vehicle.* Journal of Spacecraft and Rockets, Vol. 49, No. 4, July-Aug. 2012, pp. 574-585. See Erratum, *Investigation of Ground Wind Loads for Ares*

Launch Vehicle, Journal of Spacecraft and Rockets, Vol. 51, No. 4, July-Aug. 2014, p. 1374. [Ares I-X ground wind loads model, comparison of wind-tunnel results with limited amount of full-scale data]

10. Jones, George W., Jr.; and Farmer, Moses G.: *Wind Tunnel Investigations of Effects of Ground Winds on Saturn-Apollo Launch Vehicles.* Conference on Langley Research Related to Apollo Mission, Langley Research Center, Hampton, VA, June 22-24, 1965, NASA SP-101, pp. 161-171. [Saturn 1, 1B, and V models]
11. Jones, George W., Jr.; and Farmer, Moses G.: *Measured Pressure Distributions Around a Two-Dimension Circular Cylinder at High Reynolds Numbers*. NASA Langley Working Paper (LWP)-170, Dec. 1965. [wall-to-wall two-dimensional cylinder]
12. Jones, George W., Jr.; and Farmer, Moses G.: *Measurements of Drag on a Two-Dimensional Cylinder at High Reynolds Numbers*. NASA Langley Working Paper (LWP)-208, Apr. 1966. [wall-to-wall two-dimensional cylinder]
13. Jones, George W., Jr.; and Farmer, Moses G.: *Wind-Tunnel Studies of Ground-Wind Loads on Saturn Launch Vehicles.* AIAA Journal of Spacecraft and Rockets, Vol. 4, Feb. 1967, pp. 219-223. (Originally (no paper number) presented at AIAA/ASME 7th Structures and Materials Conference, Cocoa Beach, FL, Apr. 18-20, 1966.) [Saturn IB and V models]
14. Jones, George W., Jr.: *Unsteady Lift Forces Generated by Vortex Shedding about a Large, Stationary, and Oscillating Cylinder at High Reynolds Numbers*. ASME Symposium on Unsteady Flow (Fluids Engineering Division), ASME Paper 68-FE-36, Philadelphia, PA, May 6-9, 1968. [wall-to-wall oscillating (two-dimensional) cylinder]
15. Jones, George W., Jr.; Cincotta, Joseph J.; and Walker, Robert W.: *Aerodynamic Forces on a Stationary and Oscillating Circular Cylinder at High Reynolds Numbers*. NASA TR-300, Feb. 1969. [wall-to-wall (two-dimensional) cylinder]
16. Keller, D. F.: and Ivanco, T. G.: *Test Summary for Ares I-X Ground Wind Loads Model in Transonic Dynamics Tunnel*. Ares-AE-TA0006, Apr. 2009. [Ares I-X Flight Test Vehicle.]
17. Keller, Donald F.; and Ivanco, Thomas G.: *Wind Tunnel Investigation of Ground Wind Loads for Ares Launch Vehicle.* AIAA Paper 2010-4371, 28th AIAA Applied Aerodynamics Conference, Chicago, IL, June 28-July 1, 2010. [Ares I-X Flight Test Vehicle]
18. Killough, T. L.: *Wind-Induced Loads on a Dynamic 1/5 Scale Unfueled SM-78 Jupiter in the Launch Position*. Report No. RG-TM-62-25, Redstone Arsenal, AL, July 1962.
19. Lyons, J. M.; and Lurn, A. J.: *Ground Wind Induced Oscillations of the Titan III ITL Transporter.* Meeting on Ground Wind Loads Problems in Relation to Launch Vehicles, NASA Langley Research Center, Compilation of Papers Presented at the NASA Langley Research Center, June 7-8, 1966, NASA TM X-57779, June 1966, pp. 5.1-5.20. [7.5-percent aeroelastic model]
20. Olson, D. W.; and Peters, R. W.: *Titan III 7.5% Scale Wind-Induced Oscillations Test Phase II Final Report.* SSD-CR-66-64, Martin-Marietta Corporation, Apr. 1966.
21. Reed, Wilmer H., III; and Lynch, James W.: *A Simple Fast Response Anemometer*. Journal of Applied Meteorology, Vol. 2, No. 3, June 1963, pp. 412-416. [for use in ground wind loads studies]

22. Reed, Wilmer H., III: *Hanging Chain Impact Dampers: A Simple Method for Damping Tall Flexible Structures.* Proceedings of the International Research Seminar, Ottawa, Canada, Vol. II, University of Toronto Press, Sep. 1967. (See also: Reed, Wilmer H., III: *Suspended Mass Impact Damper.* United States Patent 3,568,805, Mar. 9, 1971.) [dampers to attenuate response to ground wind loads]
23. Reed, Wilmer H., III; and Duncan, Rodney L.: *Dampers to Suppress Wind-Induced Oscillations of Tall Flexible Structures*. Developments in Mechanics, Vol. 4, Johnson Publishing Company, pp. 881-897, 1968. [dampers to attenuate response to ground wind loads]
24. Reed, Wilmer H., III: *Chain Vibration Damper*. Aerospace Related Technology for Industry, The Proceeding of a Technology Utilization Conference held at Langley Research Center, Hampton, Virginia, May 22, 1969, NASA SP-5075, 1969, pp. 19-25. [damper to attenuate response to ground wind loads]
25. Smith, Philip; and Healy, Laura: *Atlas-II Ground Wind Loads Wind Tunnel Test Interim Test Report.* AD-89-183, General Dynamics Space Systems Division, Oct. 1989.
26. Tomassoni, John E., and Lambert, William H.: *Ground-Wind-Induced Oscillations of Gemini-Titan Air Vehicle and its Erector.* The Shock and Vibration Bulletin, Bulletin 27, Part 7, Feb. 1967, pp. 79-88.

5.3 Spacecraft

1. Anonymous: *Space Shuttle Flutter and Aeroelasticity Data Book.* Space Systems Group, Rockwell International, Downey, CA. [This document was continuously updated. It contains information from laboratory and wind-tunnel tests, analysis, and flight experiences. For example, Change notice #41, issued on Aug 18, 1980, describes the 0.14-size fin-rudder flutter tests conducted 8/29-10/27/1979 as TDT Test No. 321.]
2. Aubuchon, V. V.; and Owens, D. B.: *Boeing CST-100 Dynamic Stability Test IA-6A.* NASA Langley Research Center, Feb. 24, 2015. [dynamic stability of abort vehicle]
3. Berthold, Cecil L.: *Results of Flutter Test OS6 Obtained During the 0.14-Scale Wing/Elevon Model (54-0) in the NASA LaRC 16-Foot Transonic Dynamics Tunnel.* NASA CR-151056, Mar. 1977. [part of aeroelastic verification studies of Space Shuttle Orbiter]
4. Berthold, Cecil L.: *Results of Flutter Test OS7 Obtained Using the 0.14-Scale Space Shuttle Orbiter Fin/Rudder Model Number 55-0 in the NASA Langley 16-Foot Transonic Dynamics Tunnel.* NASA CR-151057, Mar. 1977. [part of aeroelastic verification studies of Space Shuttle Orbiter]
5. Cruz, Juan R.: *An Application of Anti-Optimization in the Process of Validating Aerodynamic Codes.* Ph.D. Dissertation, Virginia Polytechnic Institute and State University, Department of Aerospace and Ocean Engineering, 2003. [small unmanned Mars airplane]
6. Foughner, Jerome T., Jr.: *Viking Mars Mission Support Investigations in the Langley Transonic Dynamics Tunnel*. NASA TM-80234, May 1980. [an assortment of tests associated with the Viking lander]
7. Goetz, Robert C.: *Exploratory Study of Buffet and Stall Flutter of Space Shuttle Vehicle Wing Concepts*. NASA Langley Working Paper (LWP)-872, May 1970. [a series of generic configurations]

8. Goetz, Robert C.: *Lifting and Control Surface Flutter*. Space Transportation System Technology Symposium II, Dynamics and Aeroelasticity, NASA TM X-52876, Vol. II, July 15-17, 1970, pp. 177-198. [stall flutter of generic models, and other model tests elsewhere]
9. Greene, George C.; Keafer, Lloyd S., Jr.; Marple, Charles G.; and Foughner, Jerome T., Jr.: *Flow Field Measurements Around a Mars Lander Model Using Hot Film Anemometers Under Simulated Mars Surface Conditions.* NASA TN D-6820, Sep. 1972. [0.45-scale model of Mars lander, Martian Reynolds numbers simulated]
10. Hess, Robert W.; Reed, Wilmer H., III; and Foughner, Jerome T., Jr.: *Recent Studies of Effects of Ground Winds on Space Shuttle Vehicles*. NASA Space Shuttle Technology Conference, NASA TM X-2272, Apr. 1971.
11. Owens, Donald B.; and Tomek, Deborah M.: *18-CD Subsonic-Transonic Crew Module Dynamic Stability Test in the NASA LaRC Transonic Dynamics Tunnel.* Orion CEV Aerosciences Project CAP EG-CAP-07-99, NASA Langley Research Center, Hampton, VA, Feb. 2009.
12. Owens, Donald B.; and Tomek, Deborah M.: *27-AD Subsonic-Transonic Launch Abort Vehicle Dynamic Stability Test in the NASA LaRC Transonic Dynamics Tunnel.* Orion CEV Aerosciences Project EG-CAP-08-09, NASA Langley Research Center, Hampton, VA, Dec. 2009. [abort of Orion crew module]
13. Re, Richard J.; Pendergraft, Odis C., Jr.; and Campbell, Richard L.: *Low Reynolds Number Aerodynamic Characteristics of Several Airplane Configurations Designated to Fly in the Mars Atmosphere at Subsonic Speeds.* NASA TM-2006-214312, Aug. 2006. [Mars flyers]
14. Reed, Wilmer H., III: *Ground-Wind-Load Considerations for Space Shuttle Vehicles*. Space Transportation System Technology Symposium II, Dynamics and Aeroelasticity. NASA TM X-52876, Vol. II, July 15-17, 1970, pp. 143-160. [discusses plans for future model tests in TDT, presents data from tests of generic models elsewhere]
15. Tomek, Deborah M.; and Owens, Donald B.: *CEV Dynamic Damping Test in the Transonic Dynamics Tunnel.* Orion CEV Aerosciences Project CAP EG-CEV-06-23, Apr. 2006. [Orion crew module]

5.4 Recovery Systems and Decelerators

1. Corridan, R. E.: Given, J. G.; and Kepley, B. M.: *Transonic Wind Tunnel Investigation of the Galileo Probe Parachute Configuration.* AIAA Paper 1984-0823, 8th AIAA Aerodynamic Decelerator and Balloon Technology Conference, Hyannis, MA, Apr. 2-4, 1984.
2. Cruz, Juan R.; Mineck, Raymond E.; Keller, Donald F.; and Bobskill, Maria V.: *Wind Tunnel Testing of Various Disk-Gap-Band Parachutes.* AIAA Paper 2003-2129, 17th AIAA Aerodynamic Decelerator Systems Technology Conference and Seminar, Monterey, CA, May 19-22, 2003. [Mars landing decelerator]
3. Ferris A. T.; and Kelly, H. N.: *Free-Flight and Wind-Tunnel Studies of Deployment of a Dynamically and Elastically Scaled Inflatable Parawing Model.* NASA TN D-4724, Sep. 1968. [candidate Apollo-type spacecraft recovery system]
4. Foughner, J. T., Jr.; Reed, J. F.; and Wynne, Eleanor C.: *Transonic Wind-Tunnel Tests of a Lifting Parachute Model.* NASA TM X-73982, Dec. 1976. [1/4-scale model of slanted ribbon design]

5. Foughner, Jerome T., Jr.; and Alexander, William C.: *Wind-Tunnel Tests of Modified Cross, Hemisflo, and Disk-Gap-Band Parachutes with Emphasis in the Transonic Range*. NASA TN D-7759, Nov. 1974. [various size models in wake of cone-cylinder forebody]
6. Jaremenko, I.; Steinberg, S.; and Faye-Petersen, R.: *Scale Model Test Results of the Viking Parachute System at Mach Numbers from 0.1 through 2.6.* NASA CR-149377, 1971.
7. Kagawa, J. K.: *Data Report of 0.10-Scale Apollo Drogue Parachute Dynamics Model (FDC-1) Tests in the Langley 16-Foot Transonic Dynamics Tunnel to Determine Dynamic Stability Characteristics of Command Module and Parachute Combination NAS9-150.* SID 63-319, North American Aviation, Inc., Space and Information Systems Division, June 1963. (Also available as NASA CR-117236) [development of parachutes for recovery of Apollo capsule]
8. Kelly, H. Neale; and McNulty, James F.: *Inflatable Parawing Deployment Studies using a Dynamically and Elastically Scaled Model.* Specialist Meeting on Space Rendezvous, Rescue, and Recovery, American Astronautical Society and Air Force Flight Test Center, Sep. 1963. [spacecraft recovery system]
9. Levin. Alan, D.; and Smith, Ronald C.: *Experimental Aerodynamic Performance Characteristics of a Rotor Entry Vehicle Configuration II—Transonic.* NASA TN-D-7047, Feb. 1971. [unpowered models; variations of blade collective and cyclic pitch, airfoil section, and blade diameter]
10. Steinberg, Sy; Siemers, Paul M. III; and Slayman, Robert G.: *Development of the Viking Parachute Configuration by Wind-Tunnel Investigation.* AIAA Journal of Spacecraft and Rockets, Vol. 11, No. 2, 1974, pp. 101-107. (Originally AIAA Paper 1973-0454, 4th AIAA Aerodynamic Decelerator Systems Conference, Palm Springs, CA, May 21-23, 1973.) [10-percent-scale disk-gap-band models; variations in canopy trailing distance, and ratio of suspension line length to canopy diameter]
11. Tanner, Christopher L.; Cruz, Juan R.; Hughes, Monica F.; Clark, Ian G.; and Braun, Robert D.: *Subsonic and Transonic Wind Tunnel Testing of Two Inflatable Aerodynamic Decelerators.* 7th International Planetary Probe Workshop (IPPW-7), Barcelona, Spain, 14-18 June 2010. [static aerodynamic coefficients of tension cone and isotensoid inflatable aerodynamic decelerators]
12. Tanner, Christopher L.: *Aeroelastic Analysis and Testing of Supersonic Inflatable Decelerators.* Ph.D. Dissertation, Georgia Institute of Technology, Daniel Guggenheim School of Aerospace Engineering, 2012. [static aerodynamic coefficients of tension cone and isotensoid inflatable aerodynamic decelerators]

6.0 COMPARISONS OF THEORY WITH EXPERIMENT

1. Bartels, Robert E.: *An Elasticity-Based Mesh Scheme Applied to the Computation of Unsteady Three-Dimensional Spoiler and Aeroelastic Problems.* AIAA paper 1999-3301, 14th AIAA Computational Fluid Dynamics Conference, Norfolk, VA, 1999. [calculated results compared with Benchmark Active Controls Technology (BACT) experimental data]
2. Bartels, Robert E.; Funk, Christie; and Scott, Robert C.: *Analysis of Limit Cycle Oscillation Data from the Aeroelastic Test of the SUGAR Truss-Braced Wing Model.* AIAA

Paper 2015-2720, 33rd AIAA Applied Aerodynamics Conference, Dallas, TX, June 22-26, 2015. [Subsonic Ultra Green Aircraft Research (SUGAR) program, wing/engine nacelle limit cycle oscillations]

3. Batina, John T.; Seidel, David A.; Bennett, Robert M.; Cunningham, Herbert J.; and Bland, Samuel R.: *Steady and Unsteady Transonic Small Disturbance Analysis of Realistic Aircraft Configurations.* Transonic Unsteady Aerodynamics and Aeroelasticity 1987, Proceedings of a Symposium Sponsored by the NASA, Langley Research Center, Hampton, VA, May 20-22, 1987, NASA CP-3022-PT-2, 1989, pp. 467-496. (Also available as NASA TM-100557, Mar. 1988.) [flutter calculations compared with experiment for 45^0 sweepback wing]
4. Bennett, Robert M.; Batina, John T.; and Cunningham, Herbert J.: *Wing Flutter Calculations with the CAP-TSD Unsteady Transonic Small Disturbance Code.* Journal of Aircraft, Vol. 26, No. 9, Sep. 1989, pp. 876-882. (Originally, AIAA Paper 1988-2347, 29th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Williamsburg, VA, Apr. 18-20, 1988; and NASA TM-100580, Apr. 1988.) [compares calculated flutter results with experimental data for 45^0-sweep wing and clipped delta wing models]
5. Bennett, Robert M.; Seidel, David A.; and Sandford, Maynard C.: *Transonic Calculations for a Flexible Supercritical Wing and Comparison with Experiment.* AIAA Paper 1985-0665, 26th Structures, Structural Dynamics, and Materials Conference, Orlando, FL, Apr. 15-17, 1985. (Also available as NASA TM-86439, May 1985) [flexible DAST ARW-2 wing]
6. Chwalowski, Pawel; Heeg, Jennifer; Wieseman, Carol D.; and Florance, Jennifer P.: *FUN3D Analyses in Support of the First Aeroelastic Prediction Workshop.* AIAA Paper 2013-0785, 51st AIAA Aerospace Sciences Meeting including the New Horizons Forum and Aerospace Exposition, Grapevine (Dallas/Ft. Worth Region), TX, Jan. 6-10, 2013. [benchmark supercritical wing model]
7. Cunningham, Herbert J.; Bennett, Robert M.; and Batina, John T.: *Initial Application of CAP-TSD to Wing Flutter.* Transonic Unsteady Aerodynamics and Aeroelasticity 1987, Proceedings of a Symposium Sponsored by the NASA, Langley Research Center, Hampton, VA, May 20-22, 1987, NASA CP-3022-PT-2, 1989, pp. 463-475. [45^0-sweep wing and clipped delta wing]
8. Cunningham, H. J.; Batina, J. T.; and Bennett, R. M.: *Modern Wing Flutter Analysis by Computational Fluid Dynamics Methods.* ASME Paper No. 87-WA/Aero-9, ASME Winter Annual Meeting, Boston, MA, Dec. 13-18, 1987. (Also available as NASA TM-100531, Jan. 1988) [compares calculated flutter results with experimental data for 45^0-sweep wing]
9. Dalenbring, Mats; Jirásek, Adam; Heeg, Jennifer; and Chwalowski, Pawel: *Initial Investigation of the Benchmark SuperCritical Wing Configuration using Hybrid RANS-LES Modeling.* AIAA Paper 2013-1799, 54th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Boston, MA, Apr. 8-11, 2013. [benchmark supercritical wing model]
10. Doggett, Robert V., Jr.; and Cunningham, Herbert J.: *Some Applications of the NASTRAN Level 16 Subsonic Flutter Analysis Capability*. 5th NASTRAN User's Experiences (Fifth Colloquium), NASA Ames Research Center, Moffett Field, CA, Oct. 5-6, 1976, NASA

TM-X-3438, 1976, pp. 495-512. [calculated flutter results from relatively new NASTRAN capability compared to transport and arrow wings tested in TDT]

11. Gibbons, Michael D.: *Aeroelastic Calculations Using CFD for a Typical Business Jet Model.* NASA CR-4753, Sep. 1996. [correlation of CAP-TSD calculated flutter results with experimental data for semi-span business jet wing mounted to rigid half-body fuselage, paper completed by Gibbons' colleagues after his untimely death]
12. Heeg, Jennifer; Chwalowski, Pawel; Wieseman, Carol D.; Florance, Jennifer P.; and Schuster, David M.: *Lessons Learned in the Selection and Development of Test Cases for the Aeroelastic Prediction Workshop: Rectangular Supercritical Wing.* AIAA Paper 2013-0784, 51st AIAA Aerospace Sciences Meeting including the New Horizons Forum and Aerospace Exposition, Grapevine (Dallas/Ft. Worth Region), TX, Jan. 6-10, 2013. [rectangular supercritical wing pressure model]
13. Heeg, Jennifer; and Chwalowski, Pawel: *Unsteady Aerodynamic Validation Experiences from the Aeroelastic Prediction Workshop.* AIAA Paper 2014-0203, 55th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, National Harbor, MD, Jan. 13-17, 2014. [rectangular supercritical wing (RSW) and benchmark rectangular supercritical wing (BSCW)]
14. Heeg, Jennifer; Chwalowski, Pawel; Schuster, David M.; Raveh, Daniella; Jirásek, Adam; and Dalenbring, Mats: *Plans and Example Results for the 2nd AIAA Aeroelastic Prediction Workshop.* AIAA Paper 2015-0437, 56th AIAA/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials conference, Kissimmee, FL, Jan. 5-9, 2015. [benchmark rectangular supercritical wing model]
15. McCain, William E.: *Comparison of Analytical and Experimental Subsonic Steady- and Unsteady-Pressure Distributions for a High-Aspect-Ratio Supercritical Wing Model with Oscillating Control Surfaces.* NASA TM-84490, Aug. 1982. [compares doublet lattice aerodynamic calculated results with experimental results at M=0.60]
16. McCain, William E.: *Comparison of Analytical and Experimental Steady- and Unsteady-Pressure Distributions at Mach number 0.78 for a High-Aspect-Ratio Supercritical Wing Model with Oscillating Control Surfaces.* NASA TM-84589, Jan. 1983. [compares doublet lattice aerodynamic calculated results with experimental results at M=0.78]
17. Piette, D. S.; Crooks, O. J.; McCreary, W. E.; and Cazier, F. W., Jr.: *Experimental Transonic Steady State and Unsteady Pressure Measurements on a Supercritical Wing During Flutter and Forced Discrete Frequency Oscillations.* AIAA Paper 1985-0664, 26th AIAA/ASME/ASCE/AHS Structures, Structural Dynamics, and Materials Conference, Orlando, AL, Apr. 15-17, 1985. [semi-span, subsonic transport wing, data acquired for use in validating Fluid Dynamics Computer Codes]
18. Schuster, David M.; Heeg, Jennifer; Wieseman, Carol D.; and Chwalowski, Pawel: *Analysis of Test Case Computations and Experiments for the Aeroelastic Prediction Workshop.* AIAA Paper 2013-0788, 51st AIAA Aerospace Sciences Meeting, Grapevine (Dallas/Ft. Worth Region), TX, Jan. 7-10, 2013. [rectangular supercritical wing and benchmark supercritical wing models]
19. Silva, Walter A.; Perry, Boyd, III.; and Chwalowski, Pawel: *Evaluation of Linear, Inviscid, Viscous, and Reduced-Order Modeling Aeroelastic Solutions of the AGARD 445.6 Wing Using Root Locus.* AIAA Paper 2014-0596, 55th AIAA/ASME/ ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, National Harbor, MD, Jan.

13-17, 2014. [model from TDT Tests 3 and 6 adopted as one of standard AGARD (AGARD 445.6) configurations for use in validating flutter analysis methods, provides definitive data for wing described in NASA TN D-1616]

20. Yates, E. Carson, Jr.: *Preliminary Report on Candidates for AGARD Standard Aeroelastic Configurations for Dynamic Response.* 61st Meeting of the AGARD Structures and Materials Panel, Oberammergau, Federal Republic of Germany, Sep. 9-13, 1985. (Also available as NASA TM-89142, Apr. 1987) [model from TDT Tests 3 and 6 adopted as one of standard AGARD (AGARD 445.6) configurations for use in validating flutter analysis methods, provides definitive data for wing described in NASA TN D-1616]
21. Yates, E. Carson, Jr.: *AGARD Standard Aeroelastic Configurations for Dynamic Response.* Transonic Unsteady Aerodynamics and Aeroelasticity 1987, Proceedings of a symposium sponsored by the NASA, Langley Research Center, Hampton, VA, May 20-22, 1987, NASA CP-3022-PT-1, 1989, pp. 243-259. [model from TDT Tests 3 and 6 adopted as one of standard AGARD configurations (AGARD 445.6) for use in validating flutter analysis methods, provides definitive data for wing described in NASA TN D-1616]
22. Yates, E. Carson, Jr.: *AGARD Standard Aeroelastic Configurations for Dynamic Response I–Wing 445.6.* AGARD Report No. 765, July 1988. (Also available as NASA TM-100492. Aug. 1987) [model from TDT Tests 3 and 6 adopted as one of standard AGARD configurations for use in validating flutter analysis methods, provides definitive data for wing described in NASA TN D-1616]

7.0 OTHER

1. Andersen, Gerald R.; Cowan, David L.; and Piatak, David J.: *Aeroelastic Modeling, Analysis and Testing of a Morphing Wing Structure*. AIAA Paper 2007-1734, 48th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Honolulu, HI, Apr. 23-26, 2007. [large, semi-span wing model, controlled changes in geometry]
2. Cazier, F. W., Jr.; and Kehoe, M. W.: *Flight Test of a Decoupler Pylon for Wing/Store Flutter Suppression.* AIAA Paper 1986-9730, 3rd AIAA Flight Testing Conference and Technical Display, Las Vegas, NV, Apr. 2-4, 1986. [flight test of concept developed through TDT testing]
3. Cazier, F. W., Jr.; and Kehoe, Michael W.: *Flight Test of Passive Wing/Store Flutter Suppression.* 1986 Aircraft/Stores Compatibility Symposium, Wright-Patterson Air Force Base, OH, Apr. 8-10, 1986. [flight test of concept developed through TDT testing]]
4. Cline, J. H.; and Hammond, C. E.: *The History of Higher Harmonic Control (HHC) Wind-Tunnel Testing*. HHC Flight Test Demonstration and User/Industry Demonstration, Mesa, Arizona, May 10, 1984. [flight test verification of concept developed by TDT testing]
5. Ivanco, Thomas G.; Scott, Robert C.; Love, Michael H.; Zink, Scott; and Weisshaar, Terrence A.: *Validation of the Lockheed Martin Morphing Concept with Wind Tunnel Testing.* AIAA Paper 2007-2235, 48th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Honolulu, HI, Apr. 23-26, 2007. [large, semi-span model, controlled changes in geometry]

6. Mangalam, Arun S.; and Davis, Mark C.: *Ground/Flight Correlation of Aerodynamic Loads with Structural Response.* 47th AIAA Aerospace Sciences Meeting and Exhibit, Orlando, FL, Jan. 5-8, 2009. (Also available as NASA TM-2009-214644, Mar. 2009.) [SensorCraft semi-span wing, use of flow sensors to assess aeroelastic performance]
7. Reed, Wilmer H., III; and Lynch, James W.: *A Simple Fast Response Anemometer.* Low Level Wind Conference, Texas Western College, El Paso TX, Aug. 7-9, 1962. [spinoff from ground wind load studies, for use in full-scale applications]
8. Reed, Wilmer H., III; and Duncan, Rodney L.: *Dampers to Suppress Wind-Induced Oscillations of Tall Flexible Structures.* Proceeding of the 10th Midwestern Mechanics Conference, Colorado State University, Fort Collins, CO, Aug. 21-23, 1967, Developments in Mechanics, Vol. 4, pp. 881-897. [spinoff from wind load studies, model and full scale considerations]
9. Reed, Wilmer H., III: *Hanging-Chain Impact Dampers: A Simple Method for Damping Tall Flexible Structures.* International Research Seminar: Wind Effects on Buildings and Structures, Ottawa, Canada, Sep. 11-15, 1967. (See also: Reed, Wilmer H., III: *Chain Vibration Dampers.* The Proceeding of the Technology Utilization Conference, Langley Research Center, Hampton, VA, May 22, 1969, Aerospace Related Technology for Industry, NASA SP-5075, 1969, pp. 19-25. [spinoff from ground wind load studies]
10. Reed, Wilmer H., III: *Suspended Mass Impact Damper*. United States Patent, 3,568,805, Jan. 29, 1969. (See also: Reed, Wilmer H., Jr: *Suspended Chains Damp Wind-Induced Oscillations of Tall Flexible Structures.* NASA Tech Brief 68-10042, Feb. 1968.) [spinoff from ground wind load studies]
11. Reed, Wilmer H., III: *Viscous-Pendulum Damper*. United States Patent, 3,491,857, Jan. 27, 1970. (See also: Reed, Wilmer H., Jr: *Viscous-Pendulum Damper Suppresses Structural Vibrations.* NASA Tech Brief 68-10272, Dec. 1963.) [spinoff from ground wind load studies]
12. Schlecht, Robin; and Anders, Scott: *Parametric Evaluation of Thin, Transonic Circulation-Control Airfoils.* AIAA Paper 2007-0272, 45th AIAA Aerospace Sciences Meeting and Exhibit, Reno, NV, Jan. 8-11, 2007. [6-percent thick, elliptical airfoil with upper and lower surface blowing]
13. Straub, F. K.; and Byrns, E. V., Jr.: *Application of Higher Harmonic Blade Feathering on the OH-6A Helicopter for Vibration Reduction.* NASA CR-4031, Dec. 1986. [HHC, not a TDT test, but flight demonstration of a concept that was developed during TDT testing]

INDEX TO AUTHOR'S BY LAST NAME

The number(s) following an author's name indicates the page(s) on which a report authored by that person appears in the bibliography. Some individuals have more than one paper on a page. That distinction is not indicated. For instance, James E. Gardner is a co-author on six papers listed on page 7 and one paper listed on page 8. All authors are listed in this index—not just principle authors. Furthermore, in many reports only the author's initials are given on the original publication. That is necessarily how their names are listed in the bibliography. In this index a more complete name is often provided.

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

R

S

T

V

W

Y

Z

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*
01- 12 - 2016

2. REPORT TYPE
Technical Memorandum

3. DATES COVERED *(From - To)*

4. TITLE AND SUBTITLE
A Bibliography of Transonic Dynamics Tunnel (TDT) Publications

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Doggett, Robert V., Jr.

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER
432938.11.01.07.43.40.08

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
NASA Langley Research Center
Hampton, VA 23681-2199

8. PERFORMING ORGANIZATION REPORT NUMBER
L-20739

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
National Aeronautics and Space Administration
Washington, DC 20546-0001

10. SPONSOR/MONITOR'S ACRONYM(S)
NASA

11. SPONSOR/MONITOR'S REPORT NUMBER(S)
NASA-TM-2016-219355

12. DISTRIBUTION/AVAILABILITY STATEMENT
Unclassified - Unlimited
Subject Category 02
Availability: NASA STI Program (757) 864-9658

13. SUPPLEMENTARY NOTES

14. ABSTRACT
The Transonic Dynamics Tunnel (TDT) at the National Aeronautics and Space Administration's (NASA) Langley Research Center began research op-erations in early 1960. Since that time, ov er 600 tests have been conducted, pr imarily in the discipl ine of aeroe lasticity. This paper presents a bib liog-raphy of the publications that contain data from these tests along with other reports that describe the facility, its capabilities, testing techniques, and associated research equipment. The bibliography is divided by subject matter into a number of categories. An index by author's last name is provided.

15. SUBJECT TERMS
TDT, Tunnel

16. SECURITY CLASSIFICATION OF: a. REPORT	b. ABSTRACT	c. THIS PAGE	17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
U	U	U	UU	74	STI Help Desk (email: help@sti.nasa.gov)

19b. TELEPHONE NUMBER *(Include area code)*
(757) 864-9658